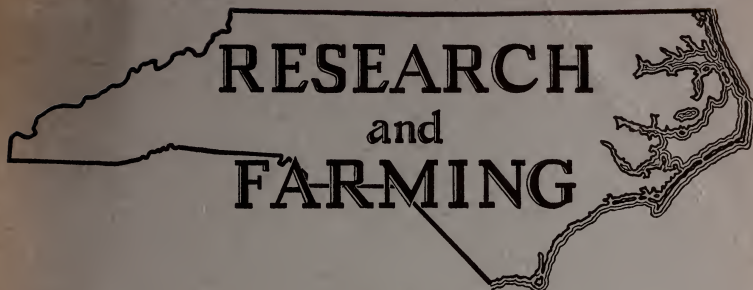


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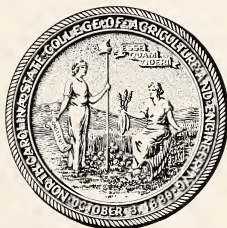
1941



Agricultural Experiment Station
North Carolina State College of Agriculture and Engineering
of the
University of North Carolina



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RESEARCH AND FARMING

1941

I. O. Schaub
Dean of Agriculture

L. D. Bayer
Director of Agricultural Experiment Station

Sixty-fourth Annual Report
of the
Agricultural Experiment Station
North Carolina State College of Agriculture and Engineering
of the
University of North Carolina
For the Fiscal Period July 1, 1940 to June 30, 1941
Progress Report for the Period December 1, 1940 to
November 30, 1941
Raleigh

STATE INSTITUTIONS COOPERATING IN AGRICULTURAL RESEARCH

State College of
Agriculture and Engineering
of the University of North Carolina

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J. W. HARRELSON, *Dean of Administration*
I. O. SCHAUB, *Dean of Agriculture*

N. C. Department of Agriculture
Raleigh, N. C.

W. KERR SCOTT, *Commissioner*
F. E. MILLER, *Director of Branch Stations**

* The six branch stations are owned and operated by the North Carolina Department of Agriculture, and the employees on these farms are members of the Department of Agriculture staff.

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Division of Cotton Marketing

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Farm Mechanical Equipment Research Division
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*To the Governor of North Carolina, the Board of Trustees and
President of the University of North Carolina and the Dean
of Administration of the North Carolina State College of
Agriculture and Engineering:*

I am transmitting herewith the report of the Agricultural
Experiment Station for the year ending June 30, 1941.

Respectfully submitted,

A handwritten signature in cursive script, reading "L. D. Baver". The letters are fluid and connected, with a prominent "L" and "B".

Director,
NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION.

Your Experiment Station Speaks:

Agriculture is a basic industry to the wealth, prosperity, and security of the state and nation. True wealth comes from natural resources. The natural resource of agriculture is the soil. Wealth from agriculture has its beginning in the production of plants in the soil—plants for the forest, plants for the livestock, plants for the human, plants for the textile mills, plants for the tobacco industry—indeed, plants that are the livelihood for scores of other industries. As the farmer, the key man in agricultural production, prospers, so do all businesses and industries based upon agriculture prosper, and the citizens of the state and nation as well. As the farmer produces the products of the soil that are essential to the health and vitality of people, so is a nation strong and secure.

Success in agriculture and the prosperity of farmers depend largely upon facts for efficiency in the production of plants and animals and the ability of the farmer to utilize such facts to his best advantage. Farming is not a static enterprise, it is exceedingly dynamic with many changing problems. New knowledge and new facts must continually be sought, established and placed within ready grasp of the farmer. This is the task of agricultural research—to seek the truth for the farmer and to establish facts upon which he can rely with the greatest confidence. Half facts or poorly interpreted facts can never build a sound agricultural program, can never command the respect and confidence of farmers or of the public. Agricultural research, through the efforts of the staffs of the Agri-

cultural Experiment Station, the Federal Department of Agriculture, and cooperating agencies, has always promoted agricultural prosperity through more efficient crop production. It will continue always towards this same objective, in times of stress as well as in times of peace and plenty. Since the general public is so dependent upon the farmer, it is obvious that agricultural research is a national and state responsibility. For, only as research meets and solves the agricultural problems arising from rapidly changing conditions will the farmer be more efficient in his production and more prosperous. As research contributes to the solution of the problems of agricultural production and marketing as well as the economic and social aspects of rural life, so will the state and nation be more prosperous and secure.

Your Agricultural Experiment Station is keenly aware of its responsibilities not only to the farmers of North Carolina but also to the general public of the state. These responsibilities are many and varied. Not only must the Experiment Station be interested in the improvement of methods of farming and providing the facts for efficiency in production and marketing, but it must also be concerned with the improvement of the rural community and rural families. American rural life has proven in the past, is proving now, and will continue to prove in the future that it is a national asset of major importance. Research in engineering, as evidenced in the radio, the automobile, and electric equipment, and research in agriculture are making the farm home a differ-

ent institution than that of the American pioneers. Through the promotion of new knowledge and new facts, agricultural research is carrying to the boys and girls of rural America an appreciation of the fact that there is culture in the profession of farming. For who can say that there is more culture in being able to appreciate a fine painting than in having the ability to judge and appreciate a fine farm animal or to understand quality and beauty in well-bred plants? Truly, the results of agricultural research reach far beyond the economics of production.

The need for research in all industries increases with the difficulties and problems that arise in the state and nation. This is particularly true of agricultural research. The farmers of North Carolina have been asked by their government to increase the production of food for freedom and oil for victory. With its country at war and with its farmers faced with a shortage of farm labor, a scarcity of farm equipment, an inadequate supply of certain essential plant nutrients and with farm wages rising faster than the prices of farm products, the Agricultural Experiment Station must meet the task of finding out facts as rapidly as possible that can be used to meet the demands of the emergency. Production is the first responsibility in achieving the goals that have been set up but we must never lose sight of the fundamental objective of all farmers—a well-balanced and profitable agricultural program after the war has been won. Increased production should not and cannot be achieved solely by planting more acres. It must be met in great measure by increased production per unit of farm labor and per unit

of capital investment. This means better farming methods, more efficiency of production and more prosperity to the farmer, now and later.

Your Experiment Station has been alert and progressive to the many changing conditions that are now confronting the North Carolina farmer. It stands ready to meet the challenge of the emergency, maintaining the ever-sound principle of making no compromise with facts that might injure the farmer or agriculture in general. Although the facts will be sought with all the speed that reliable research will justify, temporary short cuts shall not alter the steady progress that the Experiment Station has been making towards the betterment of North Carolina Agriculture. All Station projects have been revised and streamlined to give the maximum amount of information for the war effort. New short-time projects have been initiated for the sole purpose of providing facts that are now unavailable—facts that are needed to aid the farmer in helping to win the war.

In all the efforts of every patriotic farmer to do his utmost in the production of farm products essential for war, he must not forget that the soil is his basic resource. Achieving production goals is the patriotic duty of all agriculture, but achieving these goals at the expense of the future productivity of the soil will prove harmful to the future prosperity of the farmer and the nation. It is the opportunity, the responsibility of every farmer and agricultural worker to raise the efficiency of farming methods so that the fertility of every acre of soil is conserved as the productive capacity per acre is increased. This is the only safe

policy for an enduring agriculture, for a prosperous rural America. In the terms of a prominent American farmer, "We must keep the land so that the land will keep us and all generations of men. We must keep all the values of American rural life, for these values are the foundation of America's history as they must be the basis of America's future."

One of the essential features of a successful agricultural program within any state, is a close spirit of cooperation between the farmers and their agricultural institutions. The North Carolina Agricultural Experiment Station cherishes the splendid cooperation that now exists between all agricultural agencies and the farmers. It realizes that without such cooperation its efforts will largely be in vain and its usefulness considerably restricted. Since the staff of the Experiment Station are public servants, it has been the consistent policy of the Station to undertake studies of those agricultural problems that the farmers of the state feel are most important. At the moment, in this same spirit of cooperation, plans are in the making to develop a well-planned, long-

time program of research for North Carolina—a program with the farmers and for the farmers.

Your Experiment Station is embarking upon a long-needed program of getting the results of research in the hands of farmers and other agricultural workers in a form that is easily understood and readily usable. This annual report is the first issue of a regular publication on the results of agricultural research that will be available to all farmers and agricultural workers. This report contains the major achievements of the Experiment Station during the past year, written in short articles in popular style. More detailed information on any of these articles can be had by writing to the Director of the Station. Future issues will contain timely discussions of research facts, designed to keep North Carolina agriculture informed at all times of the progress of the research of the Station. It is hoped that this report, as well as all future publications, will be of great value to the farmers and agricultural workers in the state.

L. D. BAVER,
Director.

FIELD CROPS

Corn

Farmers Produce Their Own Hybrid Corn Seed

An estimated total of 100 bushels of hybrid corn seed was produced by 18 North Carolina farmers in 1941. Each cooperator crossed five strains of single-cross corn with his local variety (See Figure 1). The parent single-cross seed originated at neighboring or Corn Belt State Experiment Stations. They were distributed by the North Caro-

compared with the standard varieties. These hybrids have not responded well in the lower Coastal Plain where a long season corn is better adapted. The hybrids produce larger ears, but are often poorly covered at the tip. This weakness tends to make them susceptible to insect and bird damage. Generally, the hybrids are more resistant to lodging than are the varieties.



FIG. 1. A SEED PRODUCING BLOCK IN WHICH SINGLE CROSS-VARIETY HYBRID SEED IS BEING MADE. NOTE TASSELS HAVE BEEN PULLED FROM THREE (SEED) ROWS LEAVING TASSELS ON THE FOURTH OR MALE ROW. ALTERNATE PLANTING OF SEED ROWS AND MALE ROWS INSURES GOOD DISTRIBUTION OF POLLEN TO ALL SEED ROW PLANTS.

lina Crop Improvement Association, as directed by the North Carolina Agricultural Experiment Station. Both yellow and white seeded strains were produced. Numerous tests conducted during the past three years show a 15 per cent average increase in grain yield as

Locally Developed Corn Hybrids Show Superiority

Experimental double-cross hybrids developed from southern varieties have shown marked superiority to either local varieties or Corn Belt hybrids. In 1940 and 1941 increases of 25 per cent or

FIG. 2. A PROMISING LOCAL YELLOW DOUBLE CROSS HYBRID GROWN AT THE UPPER COASTAL PLAIN STATION, ROCKY MOUNT, N. C., 1941. THIS HYBRID HAS STIFF STALKS, BEARS TWO GOOD EARS WELL COVERED WITH HUSKS, AND AVERAGED 68.5 BUSHELS PER ACRE IN THIS FIELD.



more in grain yield above standard varieties were demonstrated by outstanding local hybrids. These hybrids are highly resistant to lodging and bear two good ears per stalk (See Figure 2). Long, tight husks cover the ear tips thus protecting the grain from insect and bird pests. In grain quality these hybrids will equal the best local varieties. Several years will be required to sufficiently increase the parent seed stocks for distribution and to complete testing of these hybrids. New greenhouse space may make it possible to release limited amounts of these hybrids by 1943.

Corn Belt Hybrids Are Poorly Adapted

Much interest has been shown by North Carolina farmers in the hybrid corn strains from the Corn Belt. Those who have tried these

hybrids give conflicting reports; some are well pleased and some disappointed in them. These conflicting reports confirm the Experiment Station's results with such hybrids. Three years testing of these indicate a rather doubtful superiority. In most tests in the state the standard varieties have averaged from 10 to 15 per cent more grain. Under some conditions, however, this has been reversed, particularly in the western half of the state. In 1941, ten of the leading Corn Belt hybrids averaged 51.2 bushels per acre as compared with 57.0 bushels per acre for the four standard varieties. Ears on standard varieties showed only 12 per cent exposed tips as compared to 75 per cent for the Corn Belt hybrids (See Figure 3). In percentage of weevilly ears, the comparison was 27 per cent to



FIG. 3. LEFT: WELL COVERED EAR TIPS OF A LOCAL VARIETY OF CORN WHICH IS RESISTANT TO GRAIN WEEVIL AND EAR-WORMS.

RIGHT: TYPICAL EXPOSED EAR TIPS OF A WESTERN HYBRID CORN. NOTE EARWORM DAMAGE TO THIS TIP AND WEEVILS WOULD SOON FOLLOW.

42 per cent for the varieties and hybrids, respectively. These hybrids were noticeably poorer in grain quality and showed considerably more earworm damage. Farmers growing such hybrids should expect some of these disadvantages.

Sweet Corn Hybrids Increase Quality of Table Corn

Preliminary trials with some of the sweet corn hybrids indicate they can be grown successfully in this state. Earworms are the chief pest in producing roasting ear corn. Several sweet corn hybrids received from the Texas Agricultural Experiment Station proved to be highly tolerant to earworm damage. Some of these were equal in eating quality to Golden Cross Bantam, a standard for eating quality. Yield of marketable ears was higher for these Texas hybrids than for the standard, although total number of ears were about equal. Their long ears (9 inches) make good roast-

ing ears even after removing a portion damaged by earworms (See Figure 4). This is not possible on some of the earlier maturing short-eared hybrids on which earworm damage is heavy. These sweet corn hybrids are well suited for early garden crops or for local markets.

Corn Yields Increased by Turning under Legumes

A comparison of two methods of utilizing legumes in a three-year rotation at the Mountain Branch Station has shown that where all the legumes, both soybeans and lespedeza, have been returned to the soil the yield of corn has been 40% greater than where all the legumes have been removed for hay; 47.6 bushels of corn were produced where all legumes have been removed for hay, and 66.7 bushels where all the legumes have returned to the soil.

FIG. 4. A PROLIFIC SWEET CORN HYBRID PHOTOGRAPHED AT THE ROASTING EAR STAGE. THESE LONG GOLDEN EARS OF TENDER SWEET KERNELS MAKE VERY ATTRACTIVE TABLE CORN. THIS TEXAS HYBRID IS TOLERANT TO EAR-WORM DAMAGE; THE EXPOSED EARS SHOW NO DAMAGE.



Cotton

Cotton Quality Increased In North Carolina¹

The quality of North Carolina cotton continues to improve. About 43% of the ginnings were Middling White and above as compared to 28% in the previous season. Only 3% was Spotted compared to a previous 17%. Practically all of the cotton stapled 1 inch and better (about 90%), and the average length was 1/32 of an inch longer than the previous season. This improvement was due primarily to planting of improved varieties and increased care in harvesting and ginning the crop. Growers, ginners, and buyers united in a one-variety

cotton improvement organizations to improve marketing conditions. A slight advantage in price was paid in those markets where all of the cotton was classified as to grade and staple.

Recent Developments In Cotton Breeding Show Improvements In Yield and Quality¹

Strains of cotton selected from commercial varieties and hybrids are showing considerable promise with regard to higher yields and improved quality. Early strains of the Mexican variety produced good yields in both the general variety test and the miscellaneous variety

¹Cooperation: Agricultural Marketing Service, U. S. Department of Agriculture.

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

and strain test. The spinning quality of 5 strains tested was good as indicated by the X-ray method. The staple length of approximately 1 inch should meet the requirements of some of the mills in the eastern part of the state.

Several lines have been isolated from Coker 100, Stoneville and other commercial varieties. A few of these have produced excellent yields and are quite uniform. The fiber quality as indicated by X-ray photographs ranged from fair to very good. One selection, Stoneville 4B-2-1, was especially good.

Breeding for Cotton Strength¹

A fertile triple hybrid has been produced which possesses fibers that are much superior to those of the Upland parent in strength, fineness and uniformity. Spinning tests have shown that yarn made from the triple hybrid cotton, which has a staple length of 1- $\frac{1}{8}$ inches, was stronger than yarns from any cotton of the same length ever before tested. The strength was 45% above the average of yarns from cotton of this staple length.

Attempts are being made to bring the desirable properties of the triple hybrid into Upland cottons by means of backcrossing. There has been some loss of strength in both of the two backcross generations which have been grown. In the second generation, the best selected plants still possess 70% of the increased strength of the triple hybrid. However, the Upland factors which have been gained more than offset this loss in strength.

Fiber Diameter Varies in Improved Varieties of Cotton

The relation of certain fiber characteristics to varieties and to

spinning quality was first demonstrated in the United States at the North Carolina Agricultural Experiment Station. It had been known for many years that fiber length depended mostly upon the variety of cotton, and it was thought that staple length and fiber strength were perhaps the only fiber characteristics affecting the market value and spinning quality of different cottons. In 1934 results at the North Carolina Station indicated that fiber weight, strength, diameter, and percentage of very thin fibers are things which depend largely upon the varieties grown. It was also found that varieties having similar staple lengths could have different fiber diameters. Spinning tests on a number of varieties possessing different fiber characteristics showed that varieties of cotton should possess a fine, strong fiber of the desired length.

Work is now being done to isolate from commercial varieties pure lines of cotton having either coarse or fine diameters and possessing staple lengths of 1 to 1 $\frac{1}{2}$ inches (See Figure 5). While the experimental results point to the fact that fine and strong cottons are best for most manufacturing purposes, there is some evidence that industry can use coarse and strong cottons to good advantage.

Water Relations within the Cotton Plant Influence Cotton Quality¹

Variations in the internal water relations of the cotton plant influence cotton quality by affecting (1) staple length, (2) fiber strength and (3) the percentage of thin-walled fibers. Stress conditions (deficiency of soil moisture) affect these different factors of cotton quality at different times during

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.



FIG. 5. ONE OF SEVERAL PROMISING INBRED LINES OF COTTON GROWN AT CENTRAL FARM, RALEIGH.

boll development. Staple length is determined during the first 14-18 days after flowering, and if drought conditions are present during the latter part of this period the fibers are shortened. Fiber strength is influenced by stress conditions chiefly in the early period of wall thickening, that is, 16-30 days after flowering. The greater the stress conditions are at that time, the stronger the fiber. The percentage of thin-walled fibers is determined to a certain extent by moisture conditions throughout the period of wall thickening (that is, 16 days after flowering until the boll opens) but chiefly by stress conditions which produce premature opening of the bolls.

Growing Conditions at Blooming Determine Number of Cotton Fibers

Recent experiments have shown that young cotton fibers begin to appear on the young cottonseeds on the day of blooming and that the fiber pattern is practically complete on about the fourth day after the bloom. After the young fibers have come out on the young seeds, the fuzz hairs begin to emerge and con-

tinue to do so for several days until the fuzz pattern is completed. Growing conditions, at the time of blooming, therefore, help to determine the number of fibers on the seed and indirectly the gin turn-out, or ginning percentage.

Seed Purity Important in All New Cotton Varieties

Experiments at the North Carolina Station show that growers who started with *pure* seed of an improved variety can keep it pure for four seasons or longer if proper precautions are taken to prevent cross-pollination by other cotton varieties in the field or mechanical mixing of planting seed at the gin. Cotton growers sometimes complain about their varieties "running out" after the varieties are planted for several seasons. Observation of seed stocks from "run down" or "run out" varieties has shown that the seed appeared to be mixed with those of other varieties. "Black" or "naked" (fuzzless) seed are usually conspicuous in "run out" varieties, and growers soon notice such seed, since the naked condition, besides being easily seen, is apparently linked with a low gin turn-

out. Recent experiments indicate that not all of the improved commercial varieties are *pure*, because of the split-up into different kinds of cottons when self-pollinated. Therefore, growers should be very careful about seed purity when buying new varieties.

Disease Resistant Varieties Best Control for Cotton Wilt¹

The use of wilt resistant varieties is the only effective means of cotton wilt control. Coker 4 in 1 has proven to be highly resistant and very productive during the past two seasons on heavily infested soil. Cleve-wilt, Wannamaker Stonewilt and certain strains of Dixie Triumph are also quite resistant and yield well. Coker 100 wilt resistant is slightly less resistant than Coker 4 in 1 but produces about as good yields. It appears to be a good cotton to plant on soils lightly infested with wilt in areas where Coker 100 strains predominate. This disease occurs principally in the Coastal Plain area, and is most destructive on the light sandy soils.

The use of liberal amounts of potash is of some benefit in controlling wilt but should be used in conjunction with resistant varieties.

More Cotton Seedlings Obtained from Reginned and Acid Delinted Seed

Comparisons of reginning and acid delinting as treatment preparations for cotton seed show that in 8 out of 11 tests, 15% more reginned seed came up and survived to thinning time than from natural fuzzy seed. Acid delinted seed was decidedly superior to either natural or reginned seed. The number of seedlings which survived to thinning time from acid delinted seed was 37% greater than from natural

fuzzy seed and 12% greater than of lint on the seed used was reduced from 14.9% found on normal fuzzy seed to 8.1%, 5.9%, and 4% for reginned lots. All the lint was re-formed by delinting with sulphuric acid.

In most of the plantings a moderate supply of moisture was available during the seed sprouting period; at no time was there an excess of moisture in the soil. Under these conditions acid delinted seed not only gave a higher percentage seedling emergence but emergence was usually somewhat more prompt than for fuzzy seed. In two plantings in which moisture during the seed sprouting period was very low, very obvious differences were observed in time of emergence; acid delinted seed reached a stand suitable for thinning about one week ahead of natural fuzzy seed. Reginned seed germinated somewhat more promptly than natural fuzzy seed under very dry conditions.

Depth of planting for both acid delinted and natural fuzzy seed should be regulated according to moisture in the soil. Both types of seed emerged more promptly when planted one-half inch deep than when planted 1 or 1½ inches deep in soil with ample but not excessive moisture. Final or total emergence, however, was highest at the 1-inch depth and lowest at the 1½-inch depth. When germination occurred in a dry soil, emergence of both types of seed was markedly delayed at the ½-inch depth and was most rapid from the 1-inch depth. Total emergence was highest at the 1-inch depth, lowest at ½-inch depth, and intermediate at the 1 and 1½-inch depth.

Certain hormone preparations which have been found to promote

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

rooting of cuttings of woody and herbaceous plants, have given only indifferent results when used as seed treatment materials for cotton seed.

More Effective Materials for Treating Seed Being Sought

Spergon and spergonex are relatively new, organic chemicals that offer considerable promise as seed treatment materials. Spergon has high adhesiveness, a property of great importance in connection with treatment of seeds having smooth surfaces. Both these preparations are volatile and their vapors are effective against parasitic organisms on cotton seed. Such vapor action greatly increases the efficiency of any material designed for treatment of cotton seed. With cotton seed, spergonex has given as good or better improvement in seedling survival than the commonly used organic mercury dust treatments, and appears to be less likely to cause seedling injury under very dry soil conditions.

Potash Essential for Cotton When Grown in Rotation with Peanuts

Extra potash applied to cotton grown in rotation with peanuts has given profitable returns at all five experimental locations. Low potash in the fertilizer caused early ma-

turity, loss of leaves, and incompletely opened bolls. The higher potash resulted in an increased yield, retarded loss of leaves and better opened bolls. Since peanuts exhaust the supply of potash in the soils, it is highly essential that more potash be included in the cotton fertilizer.

Once-over Cotton Planter and Fertilizer Distributor Developed for the Cotton Farmer¹

A combination fertilizer distributor and planter has been designed and built by the Experiment Station (See Figure 6). This machine places the fertilizer in two separate bands six inches apart, beds the land, knocks off the ridge and plants the seed at a variable depth slightly above the level of the fertilizer. Tests on this machine along with other commercial distributors and planters show that a once-over machine is desirable on the sandier coastal plain soils. The power required per acre for the once-over machine is as low or lower than other methods involving a commercial machine. The time required to plant and fertilize an acre of cotton with the once-over

¹Cooperation: Bureau of Agricultural Chemistry and Engineering, U. S. Department of Agriculture.

FIG. 6. THIS EXPERIMENTAL ONE-ROW COTTON PLANTER AND DISTRIBUTOR DISTRIBUTES THE FERTILIZER, BEDS THE LAND, KNOCKS OFF THE RIDGE, AND PLANTS THE SEED IN ONE TRIP AND REQUIRES SMALL AMOUNT OF TIME AND POWER PER ACRE. IT IS CALLED A ONCE-OVER MACHINE.



machine is about one-half or less of that required of any other method tested. In other words, at least twice as many acres can be planted and fertilized in the same time.

Tests show that the turning plow, when used for bedding, requires a large amount of time and power. Approximately 60% of the power required to plant and fertilize the seed is required by the turning plow for bedding the row. The power and time required per acre for the turning plow is higher than that required of any of the commercial distributors which bed and distribute the fertilizer. Any method which uses the turning plow for bedding, should therefore be

discouraged. Discs on a distributor would be more efficient.

If the commercial distributors that required a turning plow for bedding could be equipped with discs for the bedding operation, the power and time required per acre would be reduced approximately 50% and would compare very favorably with that required of distributors which used discs. If the commercial distributors which are equipped with bedding discs could be equipped with seed planting mechanisms, the time required per acre would be reduced by 50% and would be about the same as for the once-over machine. The power requirement per acre would probably be the same or lower than the once-over machine.

Pastures and Forage

Limestone and Phosphate Essential In Improving Quantity and Quality of Feed on Pastures¹

In field experiments in Haywood County the effect of lime and phosphate combined was first seen in the improved growth and vigor of lespedeza. The resulting increased nitrogen content of the soil was in turn reflected in a marked increase in stand and growth of blue grass. This effect was so pronounced that in four-years' time these treatments transformed a thin lespedeza sod into a heavy turf containing over 60% bluegrass. This improved sod nearly trebled the yield of crude protein and doubled the yields of calcium and phosphorus.

The first ton of limestone or the first 400 pounds of superphosphate usually give the largest and most economical return. Therefore, it will pay the farmer to apply mod-

erate amounts of these materials to all his pasture land rather than larger amounts to only a part of his acreage. In Cherokee County, potash was almost twice as effective when used with limestone and phosphate as when used alone.

Bluegrass has appeared in appreciable amounts on the lime and phosphate plots in the Cherokee County experiment without the addition of seed. This illustrates the importance of applying fertilizer before reseeding pastures; proper fertilization may eliminate the need for seed in many cases.

In establishing lespedeza in Buncombe County phosphate alone was of no value, and limestone alone was only slightly better. A combination of the two produced very satisfactory growth. The addition of a light vegetative mulch was necessary to get stands on galled areas.

On a field of low fertility in

¹Cooperation: Tennessee Valley Authority.

Caldwell County, 400 pounds of 4-16-4 increased yields 57%, while 1 ton of limestone in addition to this treatment increased yields 130%. There was twice as much lespedeza on the limed plots as on the check, three times as much on the fertilized plots and over four times as much on the fertilizer and lime plots.

Lime and Phosphate Increase Carrying Capacity of Pastures¹

One ton of lime and the equivalent of 320 pounds of 20% superphosphate per acre, applied in the fall of 1939 and spring of 1940 on three large areas in Western North Carolina, have not only increased the thickness and quality of the sod but have increased the carrying capacity of the pastures over the untreated areas. The carrying capacity was approximately 2.5 acres per yearling steer. In 1941, although an unusually dry season, the fertilized areas produced 10% more beef per acre and the cattle grazing on the fertilized areas gained 8% more per steer during the season.

In another experiment, stocked at the rate of one yearling steer per acre, lime and phosphate produced 35% more beef per acre and steers grazing on the limed area gained 29% more for the entire grazing season.

Cooperative Pasture Demonstrations Stress Better Soil Fertility

The results from 106 pasture demonstrations in 51 counties show that treatment of the soil with fertilizers and lime has increased the desirable grasses and legumes on 66 per cent of the demonstrations, and that 82 per cent of the demon-

strations have more total vegetation on the treated plots as compared to the untreated plots. Eighty-two per cent of the 79 demonstrations in 41 counties had higher yields because of the use of limestone and fertilizer. The results of this study show that complete fertilizer plus lime gave better results on the sandy soils of the lower Coastal Plain than phosphate plus lime.

Pasture Improvement Pays in Franklin County¹

Successful farmers in the Soil Conservation Demonstration Area in Franklin County say that improved pastures pay. Two dollars were received for each dollar spent on pasture improvement in the most successful demonstrations. The chief benefits were due to a saving in hay and purchased feed, and of labor.

Under present methods it costs about \$40 per acre to establish permanent pastures; of this amount, \$25 represents a cash cost of seed, fertilizer, and lime. The other \$15 represents labor and equipment charges. The most expensive single cash item is seed.

About 12% of the farmers interviewed are not performing any of the recommended pasture maintenance practices, 42% have not kept weeds clipped, and 54% have not treated their pastures with applications of fertilizer. Better maintenance practices are necessary to prevent rapid deterioration of existing pastures.

Lespedeza Should Precede Grasses On Poor Land²

Seedings of redbud, orchard, tall meadow oat grass, meadow fescue, Canada bluegrass and Kentucky

¹Cooperation: Soil Conservation Service and the Bureau of Agricultural Economics, U. S. Department of Agriculture.

²Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

¹Cooperation: Tennessee Valley Authority.

bluegrass that were made in Caldwell and Haywood counties in the spring of 1940 and in Buncombe County in the spring of 1941, failed to provide a sod, irrespective of the soil treatment.

Although most of the grasses responded to fertilizers and lime, they still occupied a small percentage of the total vegetation. The 0-16-4 fertilizer plus limestone more than doubled the growth of legumes, primarily lespedeza. The addition of nitrogen to the fertilizer treatment stimulated the grasses and weeds, but at the expense of lespedeza. The total yield was approximately the same for the 0-16-4 and 4-16-4; both treatments yielded nearly twice as much as the unfertilized areas. Since the total percentage of grasses and legumes was higher on the 0-16-4 than the 4-16-4, it is obvious that nitrogen did not aid in the establishment of a sod. These experiments have demonstrated the necessity of depending mostly upon lespedeza for the immediate returns from new pasture seedings on poor land. Such a vegetation is most economically produced with mineral fertilizers. Once the lespedeza has raised the soil fertility, grasses can be profitably grown.

Better Grassland Plants for North Carolina¹

The search for drought resistant, persistent strains of Kentucky bluegrass led to an extensive survey of the eastern half of North Carolina during the early summer of 1941. Well established colonies of this grass were found to occur along roadsides and other places throughout the lower Piedmont and Coastal Plain. Although blue grass is but rarely found in the permanent pastures of this area, it is some-

times able to maintain itself, in undisturbed soil, where soil moisture and fertility conditions are extremely unfavorable. Bulk and individual plant seed samples were collected from nearly 200 colonies, representing 51 counties, and have been used to establish a selection nursery. It is expected that strains will be found which are superior to commercial material in their adaptation to North Carolina soils and climates.

The establishment of a cytological laboratory in the past year has made it possible to undertake the investigation of seed production in Dallis grass. A large amount of material, collected from plants derived from several local and foreign sources, is now being studied. The lack of variation between individual plants and strains of Dallis grass and the uniform susceptibility of the grass to ergot, with the consequent effect upon the availability and cost of seed, have retarded efforts to improve and popularize this important pasture grass.

Ladino Clover Looks Promising in Lower Coastal Plain Pastures²

Dallis grass plus Ladino clover yielded 4,000 pounds of dry matter per acre during the growing season of 1941 at the Coastal Plain Station. This particular seeding received limestone, superphosphate and potash in 1940 but none in 1941. No other seeding mixture or soil treatment equalled this yield. Included in this particular experiment were eight legumes seeded separately with Dallis grass, under six soil fertility treatments. Yields of Dallis plus legumes (the white clovers and lespedeza appear to be the most promising) show calcium to be the first limiting factor in the

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

²Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

production of pasture herbage on this soil. The other soil nutrients needed in order of importance are: phosphorus, potassium and nitrogen.

All of the white clovers made much better growth than last year, but the superiority of Ladino over Kent wild and white Dutch is quite marked for this year. This is a large variety and usually does not have the persistence of other clovers in a grass sod. Kobe lespedeza yields were larger than all clovers except Ladino; it is recommended because of its dependability from year to year under more varied soil conditions.

Disking and Legumes Improve Carpet Grass Pastures¹

It is difficult to maintain the proper legume-grass mixture in a carpet grass sod. Individual seedings of subterranean, bur, crimson, low hop and white Dutch clovers and Kobe lespedeza were made on carpet grass that was (1) not disked, (2) single disked and (3) double disked. No disking yielded 2,140 pounds of lespedeza and carpet grass. Single disking yielded 2,970 pounds of dry matter. There was no additional gain by double disking. This increase of 830 pounds of forage can be had by disking the carpet sod in early spring and seeding to lespedeza.

Small Grains Make Good Grazing Crops¹

Comparisons of varieties of different small grains in clipping experiments at the Piedmont Branch Station over a three-year period indicate that rye, barley and oats have a place in furnishing grazing to livestock. Several varieties of barley, oats and wheat in comparison with rye have been

seeded on August 15 and clipped to simulate grazing during the fall and spring months. Enough growth is usually made by early October to permit grazing until December. Barley and rye provide the most fall grazing. The date of first fall grazing depends upon soil moisture conditions. The availability of grazing during the winter months depends largely upon the mildness of the weather. However, lighter grazing may make growth available for pasturage over a longer period than close grazing. The clipping tests have not shown crop or variety differences in the amount of fall grazing with the exception of wheat which is not adapted to an August 15 seeding date. Certain strains (Fulghum) of oats will not germinate until they have passed through a period of cold weather. To obtain stands of these strains second year or cold treated seed should be used.

When grazed in the spring, rye furnishes pasture from late February or early March until mid-April, barley from late March until early May, and oats from April through May. The varieties tested have been Iredell, Randolph, Davidson, Sunrise and Tennessee 6 barleys and Lee 5, Fulgrain, Lelina, Fulwin, and Fulghum 4 oats. Total clipping yields have shown but slight differences in these varieties for spring growth.

Following fall and February clipping, five varieties of barley have yielded 22 bushels over a two-year period; five varieties of oats have averaged 52 bushels.

In Macon County in 1941 rye and lespedeza yielded approximately 4,000 pounds of dry matter per acre. This was several hundred pounds more than the yields from either wheat or barley and lespedeza. The yields of Italian rye

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

grass were not satisfactory. Lespedeza produced more summer forage than soybeans.

A Wide Variety of Grazing Crops Used in Coastal Plain¹

A wide variety of annual crops is being used for grazing at the Lower Coastal Plain Station. These include soybeans, lespedeza, Ladino clover, sudan grass and pearl millet for summer grazing and combinations of oats-rye-vetch, Abruzzi rye-crimson clover, Italian rye-crimson clover, California bur clover, Southern Giant bur clover, and Ladino clover for winter and early spring grazing.

Grazing in 1941 on spring crops was started on March 19 and lasted through May 30. Summer grazing crops were available from July 4 through September 10. Grazing of summer crops might have been extended a little later into the fall had all soybeans been completely grazed out. After the third rotational grazing of soybeans the return growth for a possible fourth grazing was harvested for silage. Approximately 50 tons of silage were produced on 9 acres and this was stored in a temporary snow-fence type silo.

This silage was fed—as the sole roughage—to twelve bred and open heifers over a period of 35 days. The heifers totally consumed about 24 pounds daily along with 2 pounds concentrate ration. They made satisfactory gains and were in good physical condition at the end of the period. Returns from this crop, if harvested and made into silage, far exceeded what might have been obtained had the usual practice of a fourth-grazing period been followed. Handling this crop in a temporary snow-fence

silo was highly satisfactory from the standpoint of the type of silo.

The grazing season on permanent pasture extended over a period of 197 days, beginning April 20 lasting through November 3. Available grazing in April and May consisted almost entirely of hop clover, crimson clover and a small amount of bur clover and vetch. Beginning in June and throughout the season, grazing consisted of Carpet grass and scattered lespedeza.

Boron Essential for Good Alfalfa Production

In a series of 1/40 acre field plots conducted on thirteen farms throughout the Piedmont and Mountain areas of North Carolina, the application of boron to soils low in available boron has increased the yield of alfalfa. Boron was applied to duplicate plots at the rates of 8.8, 17.6, and 26.4 pounds of borax per acre representing 1, 2 and 3 pounds of elemental boron per acre. Each of these applications, with the exception of three, increased the yield of alfalfa over that of the check plots. Increases as high as $\frac{3}{4}$ ton of air-dry hay were obtained using a 26.4 pound borax application per acre for all cuttings made. The average increase for all rates of boron used, however, was over 500 pounds per acre.

Each rate of application was observed to markedly decrease the "yellows," but the highest rate (26.4 lbs. of borax per acre) seemed to be the most effective. During the latter stages of the growing season the boron treated plots withstood the invasion of crab grass much better than the check plots. This was particularly noticeable on the lighter soils. It was noted also that the application of boron increased

¹Cooperation: Bureau of Dairy Industry, and Bureau of Plant Industry, U. S. Department of Agriculture.

the number of blooms on the alfalfa plant. Seed sets were obtained only on the boron treated plots. This would seem to indicate that commercial seed stocks might be grown in North Carolina provided sufficient boron is added to deficient soils.

From the results of one year's investigations with alfalfa, it appears that for North Carolina soils, applications of 20 to 30 pounds of granulated commercial borax per acre will be ample for new or old alfalfa seedings. For the best results, applications should be made prior to seeding, or if the stand is already established, the application should be made in the fall or early winter. No application, however, should exceed 30 pounds of borax per acre. Subsequent applications of 10 pounds of borax per acre can be made when yellowing due to boron deficiency begins to appear in the stand.

Delayed Cutting Controls Leafhopper on Alfalfa¹

Tests at the Piedmont Branch Station have shown that delaying the harvest of the first crop of alfalfa until about June 1 has reduced the number of leafhoppers enough to prevent injury to the alfalfa. In a five year test from 1937 to 1941 the leafhoppers were present in large enough numbers in 1938 to cause loss of stand and stunting of the alfalfa. This infestation was controlled by delaying the first harvest until June 1. Both yield and quality of hay were decreased by the late harvest. However, during the year of the severe hopper infestation and in following years the yield of hay was least on the early harvest schedule (May 15) which lost 15% in stand. Over the five year period the average

hay yield of the early harvest schedule was 3,669 pounds and of the late harvest schedule was 3,885 pounds per acre.

Cut *Sericea Lespedeza* at Correct Time for Good Hay¹

Sericea lespedeza has been found to make the best hay when cut at a height of 12 to 14 inches. The hay is more leafy and contains less tannin when cut at this stage than when allowed to reach a greater height. The palatability of the hay is poor due to the coarse woody stems and the high tannin content when cut at heights greater than 14 inches. When cut at this height two crops can be obtained each year. Stands have been maintained at the Piedmont Branch Station over an eight-year period with an average annual yield of 2.2 tons hay per acre.

Red Clover a Failure without Lime, Phosphate and Potash

Red clover seeded without adding lime to the soil at the Piedmont Branch Station has been a failure. Very few plants have survived more than a month after germination. Although fair stands have been maintained where one ton of lime has been applied once in a four-year rotation, the growth and yields have been very unsatisfactory. Even though the yields of red clover were more than doubled by applications of lime and superphosphate, satisfactory growth was not obtained until lime, superphosphate and potash were applied. Lime, phosphate and potash plots yielded about 2,600 pounds of hay as compared with about 1,200 pounds for phosphate and lime.

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.



FIG. 7. SMALL GRAIN-LEGUME SILAGE (FOREGROUND) AND BLACK LOCUSTS (BACKGROUND) AT PIEDMONT DAIRY RESEARCH FARM.

Pasture, Legumes, Posts, and Shade on Steep Lands¹

The second year's growth of black locust planted on steep hillsides at the Piedmont Dairy Research Farm averages twelve feet in height and one and two-thirds inches in diameter one foot from the ground. (See Figure 7.) One foot seedlings were planted six feet apart in contour rows twenty feet apart. Lespedeza and a mixture of

grasses were seeded between the rows. The area was subjected to limited grazing by heifers the second year without damage to the locusts.

The progress to date indicates that this may be one of the economical methods of controlling erosion, establishing hillside pastures, and furnishing home-grown fence posts.

¹Cooperation: Soil Conservation Service.

Peanuts and Soybeans

Hunger Signs in Peanuts

Peanut plants exhibit distinct nutrient deficiencies when certain plant nutrients are not present in the soil.

Calcium deficiency symptoms in the leaf appeared first in the fully developed leaves as localized pitted areas on the lower surface. Later brown necrotic areas were visible on both the lower and upper surfaces of the leaves. Magnesium deficiency symptoms in the leaf appeared first in the older leaves which became yellow around the margins, later turning to orange; the stems became very weak and

light green in color. Potassium deficiency symptoms were first apparent in the stems, which remained slender and became intensely bright red. The leaves became light green; in late stages of potassium deficiency necrotic "Scorch" areas appeared at the leaf margins. Phosphate deficiency symptoms in the leaf were first apparent in the fully developed leaves which became increasingly dark blue green in color, the stem remained slender and the older leaves became yellow. Nitrogen deficiency was characterized by a yellowing in some areas, while the stem became distinctly red.

Boron deficient leaves resemble calcium deficiency in appearance.

Peanuts Give Best Response to Limestone, (Lime) and Potash

Recent fertilizer experiments on peanuts throughout the main peanut belt have shown the following practical results:

1. The use of 400 pounds of agricultural (dolomitic) limestone in the row at planting time has given the best results when yield, quality of peanuts, net profit per acre and the percentage of farms showing a profit are considered.
2. The use of gypsum on the foliage at blooming time has given a few outstanding yields, resulting in a slightly higher average yield and profit than from the use of limestone. However, a lower percentage of the farmers has shown increased quality and profit from the use of gypsum than from the use of dolomitic limestone.
3. Applications of potash alone increased average yields and gave a profit for the average of the fields; however, the experimental results indicate that it is not advisable to use potash

without calcium because of the observed decreases in shelling percentages, as well as the tendency for a smaller number of the tests to show a profit when calcium is omitted.

4. Combinations of lime and potash gave increases in yield of good peanuts and showed a fair profit. Combinations of lime and potash increased yield and replaced part of the potash removed by the peanut crop. Dolomitic limestone applied in the row at planting, followed by a side dressing of muriate of potash is the most economical way of applying limestone and potash and prevents possible injury to stand due to potash applied in the row.

Peanuts Are a Soil Depleting Crop

Chemical analyses of the peanut crop show that a 2,000 pound crop of peanuts with a 2-ton crop of hay removes mineral fertilizer nutrients equivalent to 300 pounds of an 0-8-34 fertilizer. The potash is equivalent to the amount in 2,575 pounds of a 4-8-4 fertilizer; calcium (lime) and potash account for about 74 per cent of the total mineral nutrients removed. The hay contains

FIG. 8. STACKS OF PEANUTS FROM JUNE, MAY AND APRIL PLANTINGS. READING LEFT TO RIGHT. APRIL PLANTING HAS GIVEN THE HEAVIEST YIELDS IN TESTS CONDUCTED AT THE UPPER COASTAL PLAIN BRANCH EXPERIMENT STATION.



about 93 per cent of the calcium, 83 per cent of the magnesium, 80 per cent of the potash and 44 per cent of the phosphoric acid removed by the entire crop. When nuts and hay are both removed from the land, it is obvious that these minerals must be returned to maintain soil fertility.

Early Planting of Peanuts Pays

An increase of 193 pounds, or 16 per cent, of marketable peanuts per acre has been obtained at the Upper Coastal Plain Branch Station during the past two years by planting on April 10, as compared to planting on May 10. (See Figure 8). Similarly, a decrease of 36 per cent in yield of nuts has been obtained by delaying planting until June 5. In order to spread out the labor of planting and harvesting, a farmer can well afford to start planting early if the weather is suitable.

Peanut Varieties Vary in Production

The 1941 results from peanut tests in five counties show a wider range of adaptation for Virginia bunch strains than for strains of larger runners. The only marked exception to this was in Perquimans County where, for the four year period, all runner strains averaged 1,775 pounds per acre as against 1,513 for Virginia bunch strains. Yields of these two types were about equal in Halifax County, but the bunch types led at all other locations, the average advantage being 105 pounds per acre.

Peanuts of this type often fill well under conditions where the larger types do not, which leads to the suggestion that they should be more widely used. This should probably be specially true where

peanuts are grown for crushing and where large types do not do well. Preliminary tests show it to have about the same soil requirements as other strains commonly grown in this area.

In addition to large seeded types, one small runner strain has produced very high yields. It has led at 4 of the 6 locations, and as an average of all tests yielded 1,527 pounds per acre as against 1,446 for the next highest strain.

Among the large-seeded strains, N. C. Selection 4 has the best record at the Edgecombe Station, while as an average for all tests N. C. Selection 31 stands first and N. C. Section 4 second. These are both of the bunch type, and are being multiplied for distribution.

Spanish peanuts, which are preferred by the crushers because of their higher oil content, have not done well in these tests. Improved Spanish 2B averaged 925 pounds per acre as against approximately 1,400 pounds for the larger types. With these differences in yield, the larger-seeded strains produced 50 to 75 pounds more oil per acre than did the Spanish in spite of their lower analysis.

In sections where root rot diseases are not a serious problem, and where Spanish type nuts are known to do well they should probably be grown for oil purposes. They cannot compete in yield with Virginia type nuts, however, on many farms in the main peanut belt.

Seed Inoculation of Peanuts May Prove Good Insurance

Inoculation of peanut seed with root nodulating bacteria before planting increased the yield of nuts 107 pounds, or 7 per cent, per acre above the uninoculated plots in

1941. In two previous years very small increases were obtained from seed inoculation. The drought in August and September, 1941 probably checked the development of all plots. However, as noticed each year, the inoculated seed plots start off faster in the spring and so had a larger crop set when the drought became severe. There has been no lack of nodulation on any of the check plots at harvest. Each field had been in peanuts, followed by one crop of either corn or cotton one year and back into peanuts for

showed the following significant facts: (1) Sulfur proved markedly superior to talc as a diluent for copper dusts. Dusts containing 6% metallic copper proved more practical than those containing 8 and 3 per cent. This was true with both talc and sulfur as diluents. (2) Gypsum showed promise as a diluent. At one location the dusts containing gypsum as a diluent gave significant increases in yield over comparable fungicides containing an inert filler. (3) In the tests in which different fungicides



FIG. 9. PEANUT STANDS AFTER TREATMENT WITH THE FOLLOWING MATERIALS: A. NEW IMPROVED CERESAN; B. HYDRATED LIME; C. ORGANIC SULFUR; D. COPPER OXYCHLORIDE SULFATE; E. ORGANIC MERCURY; F. UNTREATED.

the test. Since the cost of inoculum per acre is low (25 to 30 cents), it seems a good insurance factor and under some conditions nets a very sizeable profit.

Copper-Sulfur Dusts Continue to Show Promise in Peanut Leaf-spot Control

Experiments on the control of leafspots of peanuts during 1941 in Edgecombe and Martin counties

were compared sulfur dusts were approximately as effective as copper dusts containing 6% metallic copper. However, these dusts when used alone were not as effective as the copper-sulfur mixtures described above. (4) The test on the number and rate of applications showed 3 applications at a moderate rate to be the most practical under the drought conditions of 1941.

Seed Treatment Improves Peanut Emergence

Results of four seed treatment tests with 19 chemical dusts at the McCullers Branch Station show an average emergence of 23.2% for the untreated plots (See Figure 9). An organic sulfur dust consistently gave the highest emergence, averaging 65%. Two mercury products gave the next greatest emergence, averaging 60 and 63%, respectively. The copper materials resulted in emergences ranging from about 40 to 50%. It is of interest to note that only small differences existed in the effectiveness of the copper materials when used at the same copper concentration. A 20-80 mixture of lime and sulfur, and spergon ranked next to the mercury materials and gave average emergences of 53 and 59%, respectively. Most of the other materials gave some, but small, increases over no treatment.

Observations on the experiments reported above and results of other preliminary tests indicate that the increases in emergence obtained from seed treatment resulted from prevention of seed decay prior to germination. It was also evident in these tests that most of this decay took place during the first 3 to 4 days after seeding.

Causes and Control of Peanut Decay Being Investigated

Rot diseases of the peanut, affecting the roots, stems, and fruit,

constitute a major factor in production of this crop in North Carolina. Studies on the cause or causes of these rot diseases have shown that approximately 80% of the isolations from diseased peanut tissues yielded one or more types of micro-organisms, principally fungi. Of this group, approximately 50% were *Fusaria* sp.; 35% *Sclerotium bataticola*; 10% *Rhizoctonia*; 1% *Sclerotium rolfsii*; and the remaining 4% were unknown or contaminations.

The results of these isolations indicate a relatively scarcity of *S. rolfsii* in association with decaying peanut plants. In the past plant pathologists have generally regarded *S. rolfsii* as a prominent parasite on this crop.

Experiments are in progress to determine the effect of crop rotations and chemical treatments on the control of rot diseases of the peanut. The rotation experiments have not been in progress a sufficient period of time to warrant conclusions. However, some evidence of control has been obtained from heavy applications of copper and sulfur dusts to the surface of the soil along the peanut row in July and August.

Soybean Varieties for Seed

Herman, Tokio and Wood's Yellow continue to be the best adapted seed varieties available to North Carolina farmers. The following table may be used as a guide in selecting the variety to use:

Variety	Days to maturity	Per Cent shattering	Per Cent oil	Relative yields (bu. per acre)		
				Rocky Mt.	Wenona	Willard
Herman	160	65	21.8	16.2	21.4	15.2
Tokio	160	65	19.3	16.4	26.4	20.2
Wood's Yellow	175	5	17.7	12.5	31.2	16.4

Several other varieties which will probably be found on the market this year are worthy of note, particularly because of their non-shattering habits. These varieties are Arksoy, Early Wood's Yellow, Tennessee Non-pop and Volstate. Ogden shatters a little more than

these but shows considerable promise as a forage variety because of its luxuriant, disease-free leaves. Crosses and selections have been made in an attempt to produce high yielding, high oil, shatterproof varieties especially adapted to North Carolina conditions.

Small Grains

Low Small Grain Yields Result from Poor Cultural and Fertility Practices

An average acre of wheat in North Carolina yields 11 bushels. The average yield of wheat grown continuously on the same land for 28 years at the Piedmont Branch Station is 12.3 bushels per acre. In a three-year rotation with corn, wheat and red clover in the same field, the yield of wheat is 24 bushels per acre. The average crop of wheat is grown under conditions no more favorable than continuous cropping. If the average yield of small grain is to be improved, better fertility and cultural practices must be used.

Applying Phosphate to Small Grains Economical in Western North Carolina¹

Phosphate is seldom the limiting factor in corn production on upland soils in western North Carolina where phosphate is applied to other crops in the rotation. Experiments have shown that most of the returns from direct applications of phosphate are obtained from small grains and legumes. Barley has been found to be particularly responsive to phosphates applied to it and to previous crops in the rotation.

¹Cooperation: Tennessee Valley Authority.

Sunrise, A New Winter Barley for North Carolina¹

Sunrise, a new high yielding grain and forage barley, was distributed from the Piedmont Branch Experiment Station, Statesville, for the first time in the fall of 1940. This variety was developed in cooperation with the Division of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture. It is resistant to mildew (*Erysiphe graminis hordei*) and to several races of both covered (*Ustilago hordei*) and black loose (*U. nigra*) smut, but is susceptible to brown loose (*U. nuda*) smut.

As an average for the four years it has been on test at Statesville it has produced significantly higher yields than the next highest variety. The same is true for the average of 5 tests conducted in the Coastal Plain area in the past two years. In comparison with certain other commonly grown varieties, the yields at Statesville for this 4-year period were as follows: Tennessee 6 (Hooded), 39.2; Iredell 23 (Hooded), 49.6; Randolph (Bearded), 50.6; Davidson (Barded), 54.0; and Sunrise, 61.7.

Straw yields secured from the above varieties for the past 3 years are also highest for Sunrise. Its

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.



FIG. 10. BARLEY HEAD TYPES AS REPRESENTED BY SUNRISE, DAVIDSON AND IREDELL. READING LEFT TO RIGHT. NOTE THE PRACTICALLY AWNLESS CONDITION OF SUNRISE.

resistance to mildew, which leaves the foliage clean and bright until maturity is probably partially responsible for these heavier yields. High yields of both grain and straw, clean foliage and practically awnless type heads (See Figure 10) should make this new barley a valuable addition to the list of varieties already grown in the state.

Iredell as a forage barley and Davidson as a grain variety will, however, continue to be preferred by many growers because of their resistance to brown loose smut, as this disease can be controlled only by the hot water treatment.

Cold and Disease Resistant Oats Released to North Carolina Farmers¹

New oat varieties combining resistance to both smut and rust were distributed on a limited scale in the fall of 1940 to try them out under general farm conditions. Two of these, Lelina and Letoria, have shown up exceptionally well and went into general distribution in the fall of 1941.

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

These new oats are from a cross of Lee x Victoria. Lee has been recognized as an outstanding cold resistant variety for the Piedmont area for many years. It is, however, very susceptible to smut and to crown rust and is late in maturity. Victoria is quite resistant to both of these diseases, but will not stand our winters. Lelina and Letoria combine well the winter resistance of the Lee and the disease resistance of the Victoria.

The original cross and these selections were made by workers in the Division of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture. These same workers also put them through cold chamber tests and through artificially produced rust and smut epidemics before the Experiment Station received them for field trial. In the field at Statesville only a few plants have ever shown smut and only a trace of rust has developed, as compared with heavy infection in the Lee parent.

These selections were under observation at Statesville for the first time in the winter of 1936-37, and

have been in the regular yield tests during the past 4 years. As an average for this 4-year period they have produced as follows: Lee, 82.8; Lelina, 84.3; and Letoria, 81.8.

In comparison with Lee and Fulgrain, two widely grown varieties in the state at the present time, they would rate as follows in maturity: Fulgrain, extra early; Lelina, early; Letoria, medium late; Lee, late.

Rust Resistant Wheats Being Developed¹

Progress is being made in developing leaf rust resistant wheats for North Carolina farmers. The most promising strains isolated to date, on a basis of both yield and resistance are from a cross of

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

Malakoff x Nittany. Several of these strains showed almost complete resistance to leaf rust at locations where rust occurred in the spring of 1941, and have produced satisfactory yields. As an average for the past two years 5 selections from this cross have given average yields of 36.9 bushels per acre at Statesville, which was slightly above that for three standard varieties.

These selections are slightly harder in texture than the typical soft red winter varieties now being grown in the State, and whether or not they can be used as they are remains to be determined on a basis of baking tests. From a breeding standpoint, however, they are a decided step ahead in adaptation as compared with the original resistant varieties with which the work was started.

FIG. 11. A SECTION OF THE GRAIN NURSERY AT STATESVILLE, WITH OATS IN THE FOREGROUND, BARLEY AND WHEAT BEHIND.



Tobacco

New Varieties of Flue-Cured Tobacco Introduced¹

Flue-cured varieties Nos. 400 and 401 have been added to the list of standard varieties by the Tobacco Branch Station. No. 400 is highly resistant to Black Root Rot (Thielaviopsis). No. 401 is a cross between Cash and No. 400. Both of these varieties have some resistance to leaf spot diseases. No. 400 is recommended for areas infested with black root rot, which is more prevalent in the Old Belt (Piedmont area), and is not recommended for the Eastern and South Carolina Belts. The 401 may be planted anywhere in the flue-cured area. It is believed the 401 will add \$40.00 to \$50.00 per acre over a number of the other varieties.

A very satisfactory variety which is resistant to Black shank (Phytophthora) has been developed after numerous back crosses and selections. It is expected that this variety may be released for the 1943 crop. A resistant variety for Granville wilt and Mosaic appears to be in sight. The three latter diseases cost the tobacco farmer in the flue-cured area alone well over a million dollars annually. An almost unlimited amount of experimentation is required to get resistance to a disease and obtain high quality in the tobacco. A high quality tobacco must have not only color, texture and yield but it must have "aging" qualities, aroma and free burning qualities.

Better Fertilizer Placement and More Potash Essential for Tobacco Quality and Yield¹

The 1941 results from fertilizer studies at the Tobacco Branch Sta-

tion have further emphasized the importance of stepping up the rate of potash applications in mixed fertilizers. However, where high rates of soluble salts were used directly under the tobacco plants poor stands were secured which resulted in reduced quality and yield. Fertilizers applied three to four inches to each side of the plants or placed directly under the plants and thoroughly mixed with the soil before transplanting is done, avoided this trouble.

Large quantities of nitrogen injured the quality of flue-cured tobacco more than excesses of any other element. For this reason, the amount of nitrogen used should be kept at the minimum required to produce a satisfactory yield.

Rye Cover Crop Increases Tobacco Yields and Quality¹

Results from field experiments at the McCullers Branch Tobacco Station in 1941 showed a highly significant increase in yield and value per acre where rye was used as a winter cover crop for tobacco. This was true with three different dates of transplanting. For example, the May 5 transplanting yielded 907 pounds valued at \$324.20 following rye and 422 pounds valued at \$134.07 where no rye was used. Root rot infestation was severe on all dates of transplanting whether rye was used or not. However, observations during the growing season indicated infestation lasted longer where rye was used.

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.



FIG. 12. ROOT DEVELOPMENT OF TOBACCO ON OKEENE FINE SANDY LOAM IN RELATION TO SOIL ACIDITY. REACTION OF SOIL: NO. 1, PH 4.70; NO. 2, PH 5.16; NO. 3, PH 5.94; NO. 4, PH 6.80.

Root Growth of Tobacco Poorer On Extremely Acid Soils

Experiments on the growth of tobacco at different acidities and degree of unsaturation with bases (degree of acid saturation) have shown that the more acid the soil, the poorer is the root system. Roots did not penetrate very deeply into acid soils, and root hairs were not numerous (See Figure 12). The best root distribution and the largest number of root hairs were found on a moderately acid soil, pH 5.94 and 50 per cent saturated with bases (calcium, magnesium, potash).

Less Fertilizer Needed on Tobacco Plant Beds¹

Further studies in tobacco seed bed management at the Tobacco Branch Station indicate that, as a rule, too much fertilizer is being used. One and one-half pounds of a 4-9-3 or one pound of a 6-9-3 plant bed fertilizer to the square yard will produce as many, and in some cases more, plants than heavier applications. Insects and diseases have caused considerable damage to seed beds in many cases and have caused the farmers to double their

plant bed area to offset such damage. Both can now be controlled and narrow, well-prepared beds will produce more and better plants at less cost if insect and disease control recommendations are followed.

Controlling Weeds and Disease in Tobacco Plant Beds¹

Chemicals may be used in the seed bed to control weeds. Cyanamid, chloropicrin, urea, or a combination of cyanamid and chloropicrin, cyanamid and ammonium thiocyanate, cyanamid and salicylic acid, or urea and ammonium thiocyanate, have proved effective. Most complete eradication was obtained with a combination of one pound of cyanamid and 36 cc of chloropicrin per square yard or with urea used alone at the rate of one pound per square yard.

All treatments, except where cyanamid was used alone, showed a highly significant reduction in amount of infestation for root knot control. A combination of cyanamid and chloropicrin or urea alone or in combination with ammonium thiocyanate gave the best control.

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

Rotations Help Control Tobacco Root Diseases¹

Cropping systems, or rotation of crops, play an important part in the control of root diseases of tobacco as well as in keeping the land in the proper tilth. This is especially true of such diseases as Granville wilt, root-knot and black shank. Redtop or Herds grass appears to be the only grass that is highly resistant or immune to Granville wilt and root knot. Common weeds may be used to precede tobacco on root-knot infested land with good results. Land infested with Granville wilt should never be allowed to grow a crop of weeds.

Fusarium Wilt of Sweet Potato Also Attacks Tobacco¹

The results from field observations and from 125 inoculation trials show that losses are to be expected on flue-cured, burley and Maryland tobacco or sweet potatoes when grown on soil infested with *Fusarium* wilt of any of these crops. However, flue-cured tobacco and sweet potatoes may be safely grown on soil infested with *Fusarium* wilt of cotton. Resistant varieties of tobacco are being developed by Experiment Station workers to permit tobacco culture on wilt-infested land (See Figure 13).

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.



FIG. 13. RESISTANCE OF TOBACCO TO FUSARIUM WILT. ROW IN CENTER WAS COMPLETELY DESTROYED BY WILT. OUTER ROWS ARE RESISTANT.

HORTICULTURAL CROPS

Apples and Peaches

Apples Are Stored in a Controlled-Atmosphere

At the Apple Research Laboratory in the Brushy Mountains an air-tight apple storage room has been constructed to study varietal response to the controlled-atmosphere method of storage (See Figure 14). The first year's results of storing Stayman Winesap,

normal storage season. Apples kept in a controlled-atmosphere storage room retain their better condition much longer after the apples are taken out of storage than similar apples in regular cold storage.

The room is refrigerated to 40° F., completely filled with apples and sealed. Within a few weeks the normal process of respiration



FIG. 14. TESTING AIR SAMPLES FROM CONTROLLED ATMOSPHERE STORAGE TO DETERMINE PERCENTAGE OF OXYGEN AND CARBON DIOXIDE.

Bonum, Delicious, Golden Delicious, Red Winesap, Blacktwig, and Limbertwig were promising. Some of these apples were kept until the latter part of June in good condition. A storage room of this type is of particular value for keeping apples in first-class condition for several months longer than the

of the apples reduces the oxygen content from that in normal air, 20%, to about 11%. There is a corresponding increase in carbon dioxide from 0.5% to about 10%. At this point the excess carbon dioxide must be taken care of in one or two ways: either by admitting fresh air through a port hole in the

side of the storage, or by drawing part of the air in the storage room through an air washer in which a lye solution absorbs part of the carbon dioxide. The latter method is used; it has one advantage in that no new oxygen is admitted to the storage room, and the oxygen can be reduced to as low as 2%, still further slowing down the respiration process.

Warm Spring Evenings Favor Codling Moth Activity

Work at the Apple Research Laboratory in the Brushy Mountains has shown that emergence of the codling moth is related to the evening temperature. Codling moths were caught in bait pails in large numbers when the evening temperature was high. Although the number of moths and the dates of their emergence were very much alike for 1940 and 1941 the amount of damage caused by this pest was much greater during the 1941 season.

One of the main reasons for this great difference is the fact that the evenings during the last ten days of May 1940, just after the moths had emerged, were cool (av. 69° F.); whereas, the 1941 evenings were very warm (av. 80° F.). In 1940 the moths laid comparatively few eggs because of cool evenings, but laid many eggs in 1941 because of warm evenings.

Very few worms from eggs laid by the moths during May 1940 reached maturity and left the apple before July 10; whereas in 1941 a large number of worms reached maturity during June. These worms changed to moths in about sixteen days and in turn laid more eggs, making a much larger second brood of worms in 1941 than in 1940. Second brood moths produced a third brood of worms. Late worms

continued to enter the fruit even after apple picking was started in September 1941. These studies are supplying systematic data on codling moth activity and thereby leading to more effective control of this important pest.

Spraying with Lime-sulfur and Bordeaux Mixture Gives Best Control of Apple Bitter Rot

Investigations on four orchards in 1941 show good control of apple scab by all spray applications beginning with the pink and including the 4th cover spray (totaling 6 applications). The critical period for scab development extended from the pre-pink through the petal fall stage, as evidenced by primary ascospore discharge during this period. The most important spray applications for the control of bitter rot were the 3rd and 4th cover sprays. In all the experimental orchards apple diseases were not as prevalent as in past years due primarily to the absence of sufficient precipitation during the critical period for dissemination of the parasites. A split spray program of 1-40 lime-sulfur through the calyx and 4-4-50 Bordeaux mixture thereafter gave better control of bitter rot than did Bordeaux mixture 1-3-5 or 4-4-50, and lime-sulfur 1-40 and 1-100 throughout the season. Arsenical injury to the foliage was quite noticeable in all of the lime-sulfur plots and to a certain extent in the copper tests. Copper russetting on both fruit and foliage was quite apparent even in the weakest copper plots; the greatest russetting appeared in those plots in which strong dosages of Bordeaux mixture were applied after bloom. Since apple diseases cause an average annual reduction of about 20% in the yield and qual-

ity of the crop, an effective spray program is essential to orchardists.

Woolly Apple Aphid Threatens Nurserymen

Experiments conducted in nurseries during 1940-1941 have shown that one quart of a 1/10 of 1 per cent alkaline solution of sodium cyanide poured around the base of each apple tree killed all the aphids on the roots of approximately 90 per cent of the trees treated. Over 90 per cent of the aphids were killed on the other 10 per cent of the trees. Since the woolly apple aphids have a very rapid rate of reproduction and are able to migrate from tree to tree, it is necessary to obtain practically perfect control.

The woolly apple aphid is the most destructive insect of apple trees in the nurseries in North Carolina. One nursery alone lost 10,000 trees because of this insect in 1940 and 20,000 trees in 1941.

Peach Research Laboratory Established

A field laboratory and equipment shed have been erected near Eagle Springs as a center for research in peach production. The commercial

peach growers helped initiate the project and many are actively co-operating in field tests. The expanding program includes thirteen different growers in the Sandhills area. More than two thousand trees have been set out in the cooperative tests, and on land controlled by the Station. Provision is being made for future expansion by clearing land sufficient for tests with 1,500 trees and various soil improving cover crops.

New Peach Stock for Old Land

Tests with over one thousand trees in the Sandhills have shown that an Asiatic rootstock, resistant to rootknot (nematodes), greatly increased the survival rate of peach trees set on old orchard sites. The rootstock, Shalil, is one of several peaches introduced from Asia. Young trees of a commercial variety of peach grafted on the regular stock and on Shalil stock were set in twelve different orchards. Many of the trees on regular stocks failed to make normal growth and there was a high mortality while the trees with roots of the Asiatic variety usually thrived and few trees were lost.

In the orchards where nematode infection had been an outstanding

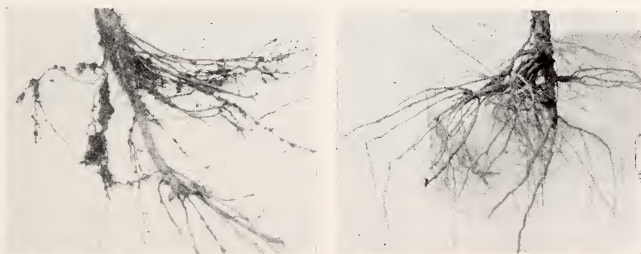


FIG. 15. ROOTS OF ELBERTA PEACH TREES GROWN ONE YEAR IN A NEMATODE INFESTED ORCHARD. LEFT: REGULAR UNDERSTOCK OF CAROLINA NATURAL. RIGHT: RESISTANT UNDERSTOCK OF THE SHALIL.

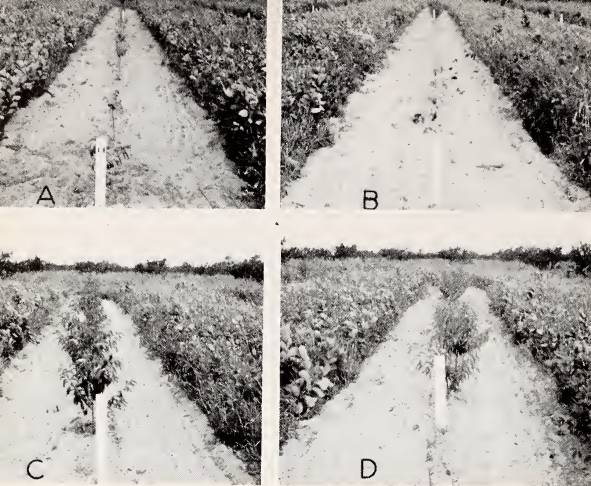


FIG. 16. CONDITION OF PEACH TREES TRANSPLANTED IN AN OLD ORCHARD SITE AT THE END OF THE FIRST SEASON AFTER THE FOLLOWING TREATMENTS: A, NO TREATMENT; B, UREA; C, CHLOROPICRIN; AND D, SHALIL ROOT STOCK.

difficulty to successful reestablishment, the use of Shalil stocks reduced the mortality during the first two years from 56% to 16%. The superiority of these stocks was not so evident in orchards having little rootknot disease (See Figure 15); the mortality rate of the trees on regular stocks being 13% against 11% for trees on Shalil stocks.

Chemical Soil Treatments and Resistant Root Stocks Offer Promise for Controlling Peach Root Diseases

Results of preliminary experiments in the Sandhills conducted during the 1941 season indicate that certain chemical soil treatments offer promising aid in replanting old peach orchard sites. In planting two old orchard sites that were heavily infested with the root-knot nematode and crown gall, the following outstanding results were obtained: (1) Shalil root stock exhibited practical immunity

to the root knot nematode at both locations but appeared equally as susceptible as native root stock to crown gall. (2) Chloropicrin gave excellent control of parasitic root infections at one location and moderate control at the other. Despite moderate root knot infection at one location, the vigor of the trees was excellent. (3) Urea gave excellent control of root knot at both locations but severely stunted the trees. (4) All other treatments gave little to no improvement in tree survival over that of the check (See Figure 16).

At the end of the growing season approximately 75% of the trees were dead on all plots except the chloropicrin and Shalil at the location where peaches had been grown for 20 years; whereas, on comparable plots at the location that had been in peaches for about 4 years about 20% of the trees were dead. These results indicate the presence of a more active complex of injurious factors in the soil following

the older orchard than following the younger one.

Partial to complete correction of the injurious complex with chloropicrin, which is supposedly completely volatile, is indicative that the injurious factor involves parasitic micro-organisms rather than a deficiency or toxic condition created by previous peach culture on the land. Cultural studies made on roots of peach taken from the experimental plots give preliminary support to the above idea.

New Emulsion for Peach Borers Not Injurious to Trees

Experiments and observations have shown that ethylene dichloride emulsion is not injurious to peach trees in North Carolina when the material is used at the recommended concentration and dosage. Miscible ethylene dichloride has been unsatisfactory because of

rapid settling and possible injury to the trees.

It is necessary to mound peach trees after treating with ethylene dichloride emulsion or P.D.B. (para or paradichlorobeneze). The mound needs only to come above the highest visible signs of borers; 2 or 3 shovelfuls of soil is usually sufficient.

Due to the difficulty of obtaining ethylene dichloride emulsion, it might be necessary to use P.D.B. in controlling the peach tree borer in the fall of 1942. Satisfactory control can be obtained with P.D.B. if it is applied between October 1 and October 25. P.D.B. should not be applied before October 1 as it may be dissipated before all the moths have completed egg laying. Treatment should not be delayed until after October 25 because the weather may be too cold for most effective results.

Small Fruits

Hunger Signs in Strawberry Plants¹

Strawberry plants, grown in different sand cultures with various nutrient deficiencies exhibit these deficiencies in the leaves within a short time.

Nitrogen leaf-deficiency symptoms appeared first in the fully developed leaves as fringe or marginal "scorch," followed by general yellowing of entire leaf. More advanced nitrogen deficiency showed restricted growth in all parts of the plant. Phosphate leaf deficiency symptoms first appeared as deep blue green coloration of the foliage followed by a purple and bronze

coloration; finally the leaves became deep red before drying up. Calcium deficiency first resulted in root injury followed by leaf symptoms. In the early stages of calcium deficiency the older leaves rapidly lost their luster and had a very dull appearance followed by leaf collapse. The young leaves of calcium deficient plants became very deformed and crinkled with prominent tip "scorch." Potassium deficiency first became evident in the leaf petioles which became discolored and brown followed by drooping of the leaves and rapid drying of the blades. Magnesium deficiency was evidenced by the general yellowing of the leaf blades near the margins which gradually

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.



FIG. 17. YIELD AT A SINGLE PICKING FROM A 50-FOOT RENOVATED ROW OF THE FAIRFAX STRAWBERRY.

advanced toward the midrib with the blades becoming somewhat brittle. Boron deficiency was evidenced by the death of the very young leaves.

Yields Reduced on Renovated Strawberry Beds¹

Contrary to a widely held opinion, renovated strawberry beds do not always outyield beds in which

the old plants are left to fruit for a second season. In a comparison of renovated triple-row beds with two-year-old beds on seven varieties at the Coastal Plain Station in 1941, the renovated beds produced less berries on all seven varieties. Renovated beds of all varieties produced on the average only about 75% as many berries as two-year-old beds.

By comparing renovated beds with both one-year-old and two-

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

FIG. 18. YIELD AT A SINGLE PICKING FROM A 50-FOOT TWO-YEAR-OLD BED OF THE FAIRFAX STRAWBERRY. THE YIELD FOR THE SEASON ON RENOVATED BEDS WAS ONLY 45 PER CENT AS GREAT AS ON THE OLDER BEDS.





FIG. 19. METHOD OF APPLYING THE FALL APPLICATION OF FERTILIZERS TO OVERCOME INJURY TO THE FOLIAGE AND INJURIOUS EFFECT OF FERTILIZER DURING DRY SEASONS.

year-old beds on the Blakemore and Fairmore varieties, the two-year-old plants again produced the most berries (See Figures 17 and 18). On Blakemore the yield was 71% on the renovated and 76% on the one-year-old beds of that obtained from the two-year-old plants. Both the renovated and one-year-old beds on Fairmore produced only 59% as many berries as the two-year-old beds.

These results indicate that unless summer conditions are favorable for the production of new runners, the renovation of strawberry beds after harvest may not be a good practice on all varieties. Renovation may result in a severe loss of stand on varieties lacking in vegetative vigor or on those susceptible to injury from high temperatures.

Apply Fertilizers in Fall to Avoid Injury to Strawberry Foliage¹

Fertilizers can be applied in the fall to the sides of the strawberry bed in the root zone without injury

to the leaves (See Figure 19). Fertilizer hoppers are available for mounting on two mule cultivators. Fertilizers applied in this manner have not caused excessive dying of the plants when applications were made during dry periods or where the application was followed by an extended dry period. Injury to the foliage is entirely overcome by this method of application.

Dusting for Control of Strawberry Mites

Plots of strawberries at Chadbourn, N. C., which were dusted with a dinitro dust, were found to have the average number of mites per leaf reduced, after a two week interval, from 9 to 12 mites per leaf to one mite per 100 to 200 leaves. The same plots showed some reduction in mites as compared to undusted plots even after a six-week period.

The dinitro dust was found to kill the mites in a very short time. Dilutions of the dust with finely ground pyrophyllite to give a concentration of only one-eighth of 1% of the active ingredient killed over

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

90% of the mites; some of the higher concentrations resulted in nearly complete elimination of the mites.

The effect of the dinitro dust on strawberry plants was slight during the cool weather but the stronger dusts sometimes resulted in severe burning of the foliage when the temperature was high.

The strawberry mite of the lower coastal plain has been found to be a new species differing slightly from the common red spider of cotton and other plants. It is difficult to control with sulfur dust or spraying.

Vitamin C in Strawberry Fruit Varies¹

Recent experimental results have shown that the vitamin C content of sun-ripened strawberries was greater than those ripened in the shade. The outer portion of the ripe strawberry contained more vitamin C than the inner portion. On the base of 100 Klondike strawberries, the vitamin C content increased from 59 mg. in green berries to 280 mg. in ripe berries. In Klondike strawberries grown in different fields, the vitamin C content varied from 36 to 56 mg. per 100 gm. of fruit. Varieties of strawberries grown in the same field at the same fertility level ranged from 66 to 32 mg. of vitamin C per 100 gm. of fruit and ranked in the following descending order as to vitamin C content: Fairmore, Missionary, Massey, Blakemore.

¹Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

High Sulfur Fertilizer Causes Leaf Burn on Blueberries

Fertilizer mixtures containing a high percentage of sulfur have caused severe leaf burn during the early summer of 1941 on the Scammell blueberry. In the high sulfur mixtures leaf burn occurred at rates of 500, 750, and 1,000 pounds per acre, being especially severe at the 1,000-pound rate. Mixtures containing a low sulfur content caused very little burning, even at 1,000 pounds per acre. On some plants, fertilized with 1,000 pounds per acre of the high sulfur mixture, more than 500 leaves per plant showed fertilizer injury. Similar results were secured during the 1940 season on the Cabot variety.

A New Pest on Blueberries

The blueberry bud mite is a new pest that was discovered on North Carolina blueberry farms in March 1939. The mites are invisible to the naked eye and live mainly in the blossom buds where they cause enlargement or galling of the cells. All affected parts of the buds acquire a warty surface often with red discoloration.

The mites caused serious damage in the spring of 1939, but since that time natural control by predatory species of mites and thrips has reduced the numbers of the pest on most of the blueberry farms. Incomplete control was obtained by the use of winter sprays of lime-sulphur and 2% or 3% miscible oil. Miscible oil at 5% or 6% gave good control. Small scale tests with a 1% oil in mid-summer indicate that this is probably the most effective time for control of the mite.

Truck Crops

Several Important Irish Potato Diseases Found in North Carolina

A survey of the eastern North Carolina potato-growing section during the harvest season of 1941 revealed that four diseases were of economic importance. These diseases were Southern bacterial wilt, black leg, scab, and early blight. Of the four diseases, greatest losses were probably caused by scab and Southern bacterial wilt. The extremely dry growing season in the eastern section probably increased the amount of scab, while retarding the other diseases. Losses from transit rots were negligible on the whole.

A brief survey of western North Carolina was made during the last of July and the first of August and late blight was found generally distributed throughout the area. A disease tentatively diagnosed as purple top was found at Swannanoa. Early blight was observed at several locations.

Experiments are in progress to develop control measures for these potato diseases.

Control Sought for Damping-off of Lettuce

Survey, isolation, and inoculation studies in 1940 and 1941 showed that *Rhizoctonia*, a soil inhabiting fungus, is primarily responsible for post-emergence damping-off of lettuce. This fungus was isolated from a high percentage of diseased lettuce plants collected from a large number of farms in Pender and New Hanover counties and produced typical symptoms of

the disease when inoculated on healthy plants.

Preliminary results indicate that certain of the copper and mercury fungicidal preparations applied to lettuce bed before and after seeding offer promise as means of combating the disease. It is indicated that substantially increased stands may be obtained by the use of several seed treating materials.

Damping-off has become increasingly severe in commercial lettuce-growing areas of North Carolina in recent years and is a limiting factor in the production of lettuce seedlings. Losses to individual growers often reach as high as 90% of the seed bed plants. Both pre- and post-emergence damping-off are prevalent but the latter appears to be the most important.

Tomatoes are Susceptible to Granville Wilt

Granville wilt (*B. solanacearum*) is best known as a serious disease of tobacco but it is also becoming recognized as a serious disease of the tomato in North Carolina, especially in home gardens.

Tomato varieties recently developed for resistance to fusarium wilt are not resistant to Granville wilt. The Louisiana Pink is the only commercial variety tested that has shown any appreciable resistance in field tests. A very small fruited species from South America, known as the current tomato, is highly resistant. Crosses and selections are being made in order to develop a good resistant variety for commercial use.

Dill Pickles with More "Eye Appeal"¹

Dill pickles attractively packed in glass are now a commercial possibility. By means of the process developed, genuine dill pickles are packed in a "polished" or clarified brine in glass containers of sizes suitable for retail trade (See Figure 20).

The development of this process places the retail marketing of the characteristically flavored genuine

ness" of genuine dill pickles, it has been responsible for an unattractive product when packed in glass containers.

The satisfactory solution of this problem is another step in the marketing of an article of diet which is rapidly gaining public favor.

Copper Dusts Control Cucumber Leaf Diseases

Results of experiments in 1941 at the Coastal Plains Branch Sta-



FIG. 20. GENUINE DILL PICKLES IN UNCLARIFIED (LEFT) AND CLARIFIED (RIGHT) BRINE.

dill in line with the modern trend of packaging food products in glass or other containers which are completely or partially transparent.

The dill possesses its highest and truest flavor when packed in the brine in which it has been cured. However, such a brine is turbid or milky at the end of the curing process. Although the turbid brine is strong evidence of the "genuine-

tion at Willard showed that a high degree of control of downy mildew and partial control of Anthracnose of cucumber can be obtained by dusting with copper fungicides. Six dusts, containing varying amounts of copper and inert ingredients were tested on the A. and C. variety of cucumbers. Of the six dusts tested, all of which markedly reduced incidence of the diseases, the one containing 6% metallic copper in an inert filler and sticker gave the best results. The diseases

¹Cooperation: Bureau of Agricultural Chemistry and Engineering, U. S. Department of Agriculture.

appeared too late in the season to cause a marked reduction in yields. However, during the latter part of the season when the diseases became severe plots dusted with the 6% copper dust gave significantly higher yields than the check plots. The rate and timing of applications and the economics of the practice are being investigated further.

Control Pickle Worms by Dusting

Barium fluosilicate dust is as effective as cryolite for control of

pickle worms on squash. Comparisons of three dusts at weekly intervals, on five varieties of bush or summer squash, showed that cryolite gave the best control on one variety and barium fluosilicate was best on the other four; 1% rotenone dust ranked third on all five varieties. Dusting at about weekly intervals was necessary to prevent pickle worms from destroying the growing tips of the vines and the young fruit of squash.

Miscellaneous

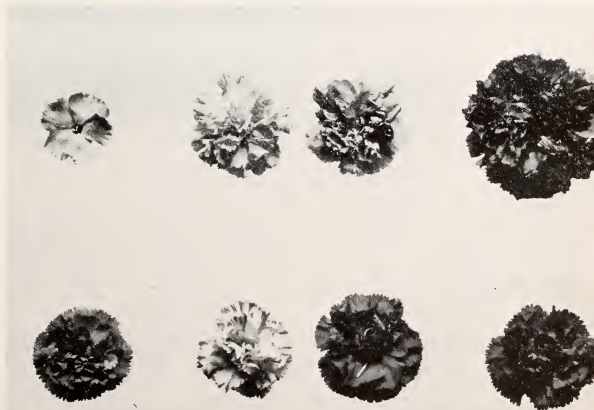
Unusual Carnation Types

A cross between Rebel x King Cardinal carnations grown in the greenhouses during the winter 1940-41 produced an unusual lot of seedlings. The unusual character of the seedlings was the number of commercially double flowers. The regular florists' carnation occurs in three forms, namely, single, double and bullhead. All commercial varieties are included in the second type. It is known that this double

type is a heterozygous form between the single and bull-head types.

When two commercial double types are crossed the resulting seedlings always come in a ratio of approximately one single, two doubles, and one bull-head. When the seedlings resulting from the Rebel x King Cardinal cross bloomed, they were all double flowers of the commercial type (See Figure 21).

FIG. 21. (TOP) SEEDLINGS EXPECTED FROM THE CROSSING OF TWO COMMERCIAL VARIETIES. (BOTTOM) TYPICAL SEEDLINGS FROM THE REBEL X KING CARDINAL CROSS.



Cape Fear, A New Pecan Variety

An open-pollinated seedling of Schley, selected from approximately one thousand seedlings planted at the Lower Coastal Plain Station, Willard, North Carolina, in 1912, has been introduced under the name Cape Fear.

The nut resembles Stuart in size and shape but is much superior in cracking quality (See Figure 22). The kernel is bright, clean and of

excellent quality, and does not break when the shell is cracked. In 1941, a very dry season, it averaged 52 nuts per pound and 54.7 per cent meat. In 1937 and 1939 the average was 62 nuts per pound with 57.8 per cent of meat. Yield tests have not been taken because of crowded conditions of growth in the seedling grove. A limited amount of bud-wood will be available in 1942.



FIG. 22. CAPE FEAR, A NEW PECAN VARIETY.

LIVESTOCK AND POULTRY

Beef Cattle

Forest Grazing and Beef Cattle Production Increasing In the Coastal Plain¹

A survey of 100 beef cattle herds in the 44 Coastal Plain counties has revealed that beef cattle production in this area is rapidly assuming an important place in North Carolina agriculture. Forest land grazing in this area makes up 29% of the year long keep of the beef cattle.

About 64% of the land is in forests. The forages available for grazing in the forests surveyed are made up of approximately 30% reed, 30% woods grass, 25% broomsedge, 14% wire grass, and 1% marshgrass types. The reed type, occurring principally in the pond pine hardwoods, is the most extensively used for cattle, as reeds have a higher carrying capacity than the other forages and can be grazed most of the year. However, they can be killed out by continuous heavy grazing spring and summer, especially following fires. The woods grass, broomsedge, and wire grass types and browse plants appear best suited for spring grazing and their use fits well into a farm program that includes improved summer pastures. Not only does the judicious grazing of beef cattle in the forests give the farmer an added annual income from his forest land while he waits for the trees to grow, but such practices greatly reduce the damage from forest fires. An average reduction in fire damage of about 45% was estimated by the one hun-

dred men interviewed on the survey.

The number of beef cattle has increased approximately 100% from 1938 to 1941 and the improvement in quality is believed to be even greater. Eighty-nine % of the bulls now kept are purebred.

Cottonseed Meal a Profitable Supplement to Reeds for Finishing Yearling Steers¹

At the Blackland Branch Station the addition of 6 pounds of cottonseed meal per head daily to steers on reed pasture increased the average daily gains per head from .24 pound in the check group to 1.49 pounds in the group receiving the cottonseed meal. This test was conducted from August 8 to November 20, 1940, a period of 104 days, using yearling steers with average initial weights of 626 pounds. Three hundred and ninety-six pounds of cottonseed meal were consumed per cwt. gain at a cost of \$5.54. The increased gain per steer of 130 pounds for the period cost only \$8.74 or \$6.72 per cwt.

Reeds are a cheap and abundant source of pasture in many sections of the Coastal Plain. Their carrying capacity is good and cows and nursing calves make satisfactory gains on them from about May 1 to November 15. However, yearling gains on reeds are very poor after about August 1.

Evidence to date indicates that the most practical utilization of

¹Cooperation: Bureau of Animal Industry and Forest Service, U. S. Department of Agriculture.



FIG. 23. PUREBRED HEREFORDS ON ANIMAL HUSBANDRY FARM AT RALEIGH.

reeds is to supplement them with a protein concentrate from about August to November and then finish the steers in the feed lot.

More farmers are practicing controlled breeding, realizing that calves of uniform age require less labor in weaning, feeding and management, and are marketed to better advantage. An increasing number are also using mineral supplements to obtain thrifty condition, proper growth, and a good calf crop. Mineral deficiencies are more critical in some areas than in others.

Cottonseed Meal a More Profitable Supplement Than Corn for Wintering Beef Cattle

Results of an experiment conducted in the mountains of North Carolina during the winter of 1941 indicate that it may often actually be more profitable to sell corn and buy cottonseed meal as a supplement to grass hay for wintering beef cattle.

Yearling steers weighing around 415 pounds, that were fed 2 pounds of cottonseed meal per head daily over a three month feeding period, gained 18.2 pounds while steers fed

2 pounds of corn lost 4.4 pounds per head. However, the group wintered on corn and hay gained 19.4 pounds more per steer on grass the following summer than the group fed cottonseed meal. For the entire period the steers fed cottonseed meal returned \$1.51 more profit per steer in beef and in fertilizing value returned through manure.

Creep-Fed Calves Make Rapid Gains

Results of a two-year test in Western North Carolina indicate that creep-feeding may play an important role in certain types of beef cattle production. Suckling calves on pasture, weighing around 225 pounds at beginning of the test, gained 54 pounds more per calf over a 100-day feeding period, than calves receiving no grain. They were fed approximately 8 parts corn, 2 parts oats and 1 part cottonseed meal. Moreover, the dams of the creep-fed calves made 42% greater gains during this period than for the group on pasture alone.

By creep-feeding producers can have their calves fat enough for slaughter soon after weaning time.

The data indicate that under present beef prices, creep-feeding will be profitable only where calves are to be sold for slaughter soon after weaning and will, therefore, com-

mand a higher price per pound. Creep-feeding may also be advisable for purebred breeders desiring to grow calves as rapidly as possible.

Dairy Cattle and Animal Nutrition

Mastitis Is Dairymen's Number One Problem

The testing of a limited number of representative dairy herds indicates the presence of mastitis in most herds. Judging from the results of the second test on a number of herds, it is evident that dairymen are beginning to realize its importance as indicated by their attention in culling (thus decreasing the number of reactors), the carrying out of recommended sanitary practices, and the attention given to the remaining individuals in the herd by grouping them according to the amount of infection as indicated by the test. No one test has proved one hundred per cent accurate but a combination of a few of them promises to be a valuable instrument in controlling this disease.

Small Grain-Legume Silage Mixture Produces Good Yields

At the Piedmont Dairy Research Farm near Statesville (See Figure 7) a mixture of oats (1 bu.), wheat ($\frac{1}{2}$ bu.), barley (3 pecks), vetch (10 lbs.), and Austrian peas (15 lbs.), yielded 12.6 tons of green weight per acre. Six acres were ensiled green with 60 lbs. of molasses per ton; the balance was used for hay. In both cases a high quality roughage was obtained. Small grain-legume silage mixtures have rather wide application over North Carolina.

Limestone and Phosphate Increase Vitamin A Content of Pastures¹

Results for the season of 1940

¹Cooperation: Tennessee Valley Authority.

FIG. 25. AYRSHIRE HERD GRAZING ALFALFA AT THE PIEDMONT DAIRY RESEARCH FARM, STATESVILLE.



show that the use of limestone and phosphate fertilizer on pasture sod, has increased the yield of carotene, the source of necessary vitamin A in cattle feed. This resulted from the increased pasturage produced by fertilization.

The percentage of carotene in the grass was likewise increased. The more luxurious grass was of a

better quality due to this source of vitamin A than stunted grass from poor soil where no fertilizers had been used.

Since high grade hays and luxurious grasses are rich in carotene, the effect of limestone and phosphate fertilizers on the stand and quality of grass is important to every livestock man.

Hogs

Supplements To Corn for Fattening Pigs

Experiments at the Blackland Branch Station, Wenona, with seventy-two 87-pound pigs have shown that tankage (50%) alone as a supplement to white corn returned more profit and required less feed per unit of grain than did a mixture of one part tankage and two parts peanut oil meal. The substitution of cottonseed meal for one part of the peanut oil meal improved the ration slightly but, the mixture was not as efficient as tankage alone. The group of pigs that was fed tankage alone required 390 pounds of feed per cwt. gain as compared to 417 pounds for the tankage-peanut oil meal group and 410 pounds for the tankage-peanut oil meal-cottonseed meal group. The gains were slightly more rapid in those groups receiving the mixed protein supplement. All groups of pigs were self fed and under these conditions those receiving the mixed supplement ate more supplement and less corn than did the tankage group. For example, the tankage group ate 90% corn and 10% tankage while the mixed protein groups each ate approximately 8% tankage, 16% plant protein and 76% corn.

A fourth group of pigs was fed 55% fish meal as a supplement and although they gained more rapidly than the tankage group, 1.81 versus 1.77 pounds per pig per day, they required 406 pounds of feed per cwt. gain as against 390 pounds for the tankage group.

Previous trials at this station showed that when peanut oil meal was self fed as the sole protein supplement to corn for fattening pigs that it was consumed in much greater quantities than were necessary to balance the ration and correspondingly less corn was consumed so that the cost of the ration was increased since peanut oil meal was more expensive per pound than corn.

A Mineral Mixture Is A Satisfactory Supplement to "Hogged Down" Mature Soybeans¹

Experimental results show that 40 pound pigs, when allowed to "hog down" mature Tokio soybeans until they attained average weights of 85 pounds, gained 0.76 pounds daily when fed a protein-mineral supplement at the rate of ½ pound of supplement per pig per day. Similar pigs self fed a mineral mixture as the only supplement to

¹Cooperation: Bureau of Animal Industry, U. S. Department of Agriculture.

"hogged down" soybeans gained 0.66 pound per pig daily. When each of these groups was taken off of soybeans, confined in a dry lot and finished to an average weight of 225 pounds on a corn-cottonseed meal ration the pigs that received only mineral with their soybeans gained an average of 1.86 pounds

daily as compared to 1.76 pounds per pig daily for the other group. It appears from these results that a mineral mixture is just as satisfactory and much cheaper than a protein-mineral mixture when soybeans are "hogged down" by 40 pound pigs.

Sheep

Native Ewes Most Profitable for Lamb Production

Choice native North Carolina yearling ewes of Hampshire breeding surpassed western-bred yearling ewes by \$2.20 in lamb returns per ewe and weaned a 35% larger lamb crop in two experiments conducted in Western North Carolina during 1940-41. The native ewes were grade Hampshires and the western ewes were Rambouillet-Hampshire crossbreds purchased from Montana. The various groups were all bred to a purebred Hampshire ram.

Although only slight differences were noted between choice and medium grade lambs when bred as lambs, ewes that graded choice as lambs, when bred as yearlings,

weaned a 20% larger lamb crop than ewes of the medium grade and showed \$0.27 more lamb return per ewe. Choice ewes bred first as yearlings weaned 71% larger lamb crop and showed a lamb return of \$5.64 more per ewe than choice lambs bred as lambs.

The western ewes produced lambs which graded slightly higher when sold, bringing \$0.29 more per hundred and reaching market about 4 weeks younger in age than lambs from either of the native groups. This fact was more than offset, however, by the greater percentage of twins from the native ewes, resulting in a much greater lamb return per ewe than from the western ewes.

FIG. 24. HAMPSHIRE SHEEP GRAZING ON SOYBEANS AT ANIMAL HUSBANDRY FARM AT RALEIGH.



Mineral Mixture Increases Lamb Production

Hampshire ewes, at the Blackland Branch Station, when given access to a mineral mixture in addition to salt, produced more twins, stronger lambs at birth, fewer dead lambs at birth, and lower death losses in the lambs from birth to weaning than ewes that had access only to salt in addition to their regular ration. The mineral mixture was composed of ground limestone 40 pounds, steamed bone meal 40 pounds, salt 17.5 pounds, cop-

peras 2.4 pounds, and bluestone 0.1 pound. Over a three-year period, the group that received the mineral mixture produced an average of 21% more twins. Furthermore, there were 24% more lambs that graded strong or very strong at birth, 18% less were dead at birth, and 26% less died between birth and weaning than in the check group. The regular ration consisted of almost year long grazing, supplemented with soybean hay in severe weather and when grazing was not available.

Turkeys and Poultry

Valuable Breeding Stock of Barred Plymouth Rocks and Rhode Island Reds Being Developed

Studies on the performance of uncultured female progeny of single matings of Barred Plymouth Rocks and Rhode Island Reds at the Central Experimental Plant at Raleigh have shown an average egg production of 244.4 eggs for the Barred Rocks and 249.6 eggs for Rhode Island Reds (See Figure 26). The laying house mortality of the

Barred Plymouth Rocks was 21.5%; 91.4% of the hens laid standard-sized or larger eggs. The mortality of Rhode Island Reds was 28.4%; 86.5% of the hens laid large eggs.

At the Lower Coastal Plain Branch Station, 33 families of Rhode Island Reds, including 276 birds, started the laying year. Sixty-six birds finished with an average production of 213 eggs; 83.3% laid standard-sized or larger

FIG. 26. TESTS FOR LONGEVITY SHOW THAT CERTAIN FAMILIES POSSESS THIS TRAIT. THIS BARRED PLYMOUTH ROCK LAID 822 EGGS IN FOUR LAYING YEARS.



eggs and the laying house mortality was 16.0%.

Crossbred Pullets and Layers May Be Superior to Purebreds

Results obtained at the Mountain Branch Station show that poultrymen who rear crossbred broilers can keep pullets and obtain higher production than from purebreds of the same grade of stock. Barred Plymouth Rocks, New Hampshires, and White Leghorns were crossed in all possible ways, with single male matings, so that half-sister purebreds and crossbreds were

while the best records made by crossbreds were 294, 298, 307, 313, and 313.

Further results indicated that better livability and faster growth can be expected from crossbred broilers than from purebreds. During the season of 1941 Barred Plymouth Rocks, Rhode Island Reds, and White Leghorns were crossed in all different ways. Even the Rock-Leghorn and Red-Leghorn crossbreds were heavier at ten weeks of age than purebred Rocks and Reds. While the Red-Rock (See Figure 27) or New Hampshire-

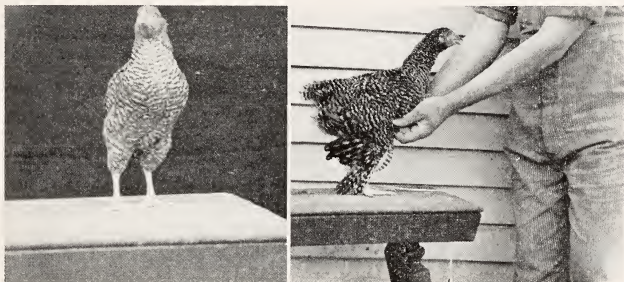


FIG. 27. CROSSBRED BROILERS FROM MATING RHODE ISLAND RED HENS WITH BARRED PLYMOUTH ROCK MALE. NOTE THE LIGHT BREAST AND ABSENCE OF BARS ON THE UNFOLDED WING FEATHERS. THESE CROSSBREDS WERE ALMOST ONE-HALF POUND HEAVIER THAN HALF-BROTHER AND HALF-SISTER PUREBREDS AT TEN WEEKS OF AGE.

available for comparison. In spite of showing more broodiness, every group of crossbreds out-performed purebred half-sisters in livability and production.

New Hampshire-Barred Rock crossbreds averaged 22 more eggs than purebred New Hampshires, and 29 more than purebred Rocks. New Hampshire-White Leghorn crossbreds averaged 64 more eggs than purebred New Hampshires. The highest record made by a purebred in these experiments was 237,

Rock cross is slightly preferred, results demonstrate that where large supply flock of Leghorns are available, broilers can be obtained by using Rock or Red males which will grow as well or better than purebred Rocks or Reds. When broilers are sold alive, the Rock cross is better because the color is almost entirely white, while from ten to twenty per cent of the Leghorn-Reds have considerable redness in the plumage.



FIG. 28. THIS GROUP OF LARGE BRONZE TURKEY TOMS IS READY FOR SHIPMENT TO TURKEY GROWERS IN ANSON COUNTY. THE RESULTS OF TESTS AT THIS STATION ARE THUS CARRIED BACK TO THE INDUSTRY.

Turkey Families Show Wide Variation in Performance

Forty-one families of turkeys containing 169 females were studied as to intensity of lay, amount of broodiness, sexual maturity and mortality rate. Intensity of lay was figured by dividing the total days in production by the number of eggs laid, and broodiness by dividing the total days in production by days lost because of broodiness. The average intensity of lay of the entire group was 58.9%, the % broodiness was 7.7, and the % laying house mortality was 10.6.

A study of 28 families containing three or more birds showed 13 families above the average and 15 below. The range in intensity of lay was from 44.3% to 69.3% and broodiness varied from 0 to 24.7%. Age at which laying began (sexual maturity) ranged from 290 to 334 days. Only one death occurred during the laying season in the 58 members of the 13 families performing over the average, while 14 deaths occurred in the 82 members of the 15 families below the average.

Studies have indicated that where superior rate of lay and hatchability existed in the first year, it was economical to carry the birds for a second year as breeders.

Sanitation Important in Controlling Paratyphoid Infection of Turkeys

Recent Experiment Station findings emphasize the great importance of sanitation in handling breeder turkeys and give hope of a method for the eradication of the dread paratyphoid disease by the detection of breeder carriers. These studies likewise indicate that there is the possibility of controlling the disease in its worst phase by incubator fumigation, a precaution that should kill all disease organisms to be found on the shells of incubating eggs.

Very promising information has been obtained on the probable route of the disease organism from the infected breeder to the poul. All results have indicated that this is essentially an intestinal rather than a blood (septicaemic) disease of adult turkeys. In studying whether or not the egg shell rather than

its contents was the vehicle of transmission of the disease organism from the adult to the poult, the shell of the unbroken egg was first cultured bacteriologically, then the egg shell was sterilized and the whole of the contents cultured. It was interesting to note that recoveries from the egg shell were quite frequent and all of the later recoveries from the egg contents were associated with an infected cracked shell.

The causative disease organism could be recovered almost daily from the common drinking bucket of one lot of artificially infected adults. Several weeks after infection the bucket was scalded each day and the organism was not re-

covered from the bucket after the first scalding.

Studies on 80 artificially infected poults, as well as on survivors of diseased poults, clearly have indicated that infected poults do not become chronic carriers of this disease.

Seven different kinds of antigen (blood testing fluids) have been used and one of them, the specific "H" antigen, gives promise of developing into a satisfactory antigen for blood-testing turkeys for carriers of this paratyphoid organism. In every case where an adult turkey was positive to this test at the time of autopsy, the paratyphoid organism was recovered from one or more of the internal organs or from the intestinal tract.

SOILS AND FERTILIZERS

Soils

New Soil Conservation Experiment Station Established in Bright Tobacco Area¹

The Soil Conservation Experiment Station which was established near Statesville, North Carolina, in 1930 was discontinued in 1940, and has been replaced by a new station in the bright tobacco area of the Piedmont located in Wake County, 12 miles east of Raleigh. The new station is established for the purpose of studying problems relating to the control of erosion on tobacco land and to the developing of soil conservation practices which do not injure the quality of tobacco. Like the old station, the new experiment station is a cooperative project between the North Carolina Experiment Station, which furnishes the station land and buildings, and the Soil Conservation Service, which furnishes the personnel and most

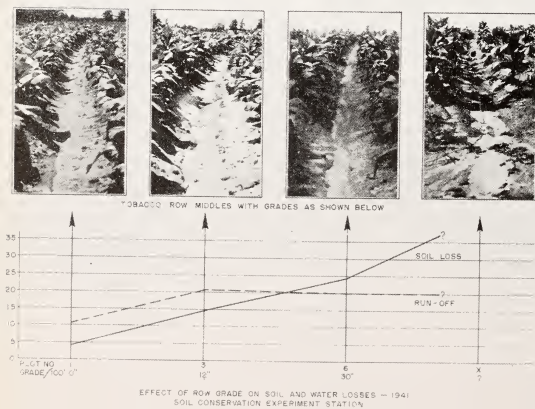
of the equipment. The project headquarters are also provided on the State College campus.

Correct Grades of Tobacco Rows Necessary for Proper Drainage and Erosion Control¹

One of the field experiments conducted at the new station is a study of the relation of row grade to soil loss, row drainage, and quality and yield of tobacco. Preliminary results obtained during the first year of the experiment indicate a very definite and rapid increase in soil loss as the grade of the row is increased (See Figure 29). The soil loss increased from about 4 tons per acre on the plot with a zero grade to about 24 tons per acre on the plot with 30 inches grade per 100 feet. The surface run-off, on

¹Cooperation: Soil Conservation Service, U. S. Department of Agriculture.

FIG. 29. STEEP ROW GRADES CAUSE EROSION IN TOBACCO FIELDS.



the other hand, increased markedly with grades up to 6 inches per 100 feet and slightly with grades between 6 and 12 inches fall per 100 feet; it remained approximately constant for the steeper grades. These results indicate that satisfactory row drainage can be secured with row grades of around 6 to 12 inches fall per 100 feet and that severe soil loss will occur on rows with steeper grades.

It is interesting to note from the records that approximately one-half of the total annual soil loss from each plot was caused by one storm totaling 5.72 inches, which occurred on the afternoon of July 13, 1941.

Heavy Summer Storms Responsible for Most of Soil Loss from Cultivated Land¹

Seasonal records of run-off and soil loss from experimental plots making up a 4-year rotation of cotton, corn, wheat, and lespedeza show that 72% of the total annual soil loss and 59% of the total annual run-off occurred during the three summer months of June, July, and August. While the rainfall was fairly well distributed over the four seasons, only a small amount of run-off and soil loss occurred during the winter months of December, January, and February. Soil loss from wheat was relatively low but run-off was greater than for either cotton or corn in the rotation.

Field Experiments Show Value of Land Cover in Controlling Erosion¹

Experiments recently completed at the Statesville station show soil loss from land in row crops to be heavy but only about one-half of that from bare soil. A 4-year rota-

tion of cotton, corn, wheat, and lespedeza reduced soil losses to less than one-half of that from continuous cotton. This was due to the protection afforded by the wheat and lespedeza and to the residual effect of the lespedeza sod.

A well-established permanent sod of perennial pasture plants afforded almost complete protection against both soil and water loss.

Undisturbed woodland lost only a trace of both soil and water. Burned woodland, on the other hand, lost slightly more water than either cotton or corn in the 4-year rotation, as well as a significant amount of soil.

Compost, Woods Litter, and Manure Increase Cotton Yields and Decrease Soil and Water Loss¹

Final results of the cotton-organic matter plot experiment conducted at the old Soil Erosion Station near Statesville show definitely that organic matter in the form of stable manure, woods litter compost, and woods litter is very effective in increasing the yields of cotton as well as in decreasing run-off and soil loss. On plots receiving no commercial fertilizer and planted to continuous cotton, the plot receiving no organic matter allowed 34 tons of soil loss per acre and produced only 439 lb. of seed cotton per acre. An application of 8 tons of stable manure reduced the soil loss to less than 7 tons per acre and increased the yield to 2,157 lbs. of seed cotton. Compost and woods litter were somewhat less effective in reducing soil loss and in increasing yield, but were highly beneficial.

¹Cooperation: Soil Conservation Service, U. S. Department of Agriculture.

Flood Control Study Made in Mountains¹

In cooperation with the State Extension Service, a complete flood control study was made of the upper French Broad and Pigeon River valleys in Madison, Buncombe, Henderson, Transylvania, and Haywood counties. This study grew out of the request from industrial, urban and agricultural interests which were materially affected by severe floods in August 1940. In order to determine what effect changes in land use would have upon modifying floods in this area, a system of land cover classification was set up by which definite evaluations could be given to land use and to changes in the same. Run-off and infiltration (water intake) rates were available on individual drainage basins, and a comprehensive picture of present soil and cover conditions was obtained for the entire study area. Farmers and agricultural agencies working together have set forth a long-term land use program—based on sound agricultural and forestry practices—which they feel is workable and will be followed. The procedure followed and results obtained by farmers in the unit test demonstration work during the last five years served as the foundation in building this projected program. The tangible benefits of the plan are far in excess of the estimated cost of bringing about better control of run-off water, through the use of rotations, winter cover, lime and fertilizer, retirement of steep land to permanent cover, and control of grazing and burning in woodlands. The less tangible, but equally important benefits, will be an improved diet and a better nourished farm people resulting in

a more contented rural-industrial group; and a greater supply of vegetables, milk, butter, eggs, and meat for the local towns and industrial centers—foods which will contain a higher proportion of the essential vitamins and minerals because the soils upon which they are produced will have a good fertility balance.

Soil Acidity Relationships May Aid in the Classification of Soils

Soil acidity may be classified as active and potential acidity. The active acidity refers to the hydrogen ions (acid ions) which are dissociated (free and active); it is measured and expressed as pH. The potential acidity refers to the hydrogen ions which are not free or active; they are the reserve ions. This form of hydrogen is measured and expressed as exchangeable (capable of being replaced) hydrogen. In addition to the exchangeable hydrogen, the soil contains exchangeable bases, such as calcium, magnesium, potassium, sodium and ammonium. A soil containing exchangeable bases is said to be base saturated (or neutral) and a soil containing exchangeable hydrogen is said to be base unsaturated (or acid). The sum of the exchangeable hydrogen and exchangeable bases is termed the base exchange capacity of soils.

The percentage base unsaturation of various soils of North Carolina has been measured at various acidities. Definite curves have been obtained which have revealed marked differences for the various soils, indicating an applicability of this method as an aid in the classification of soils.

Downward Penetration of Lime Is Slow on Very Acid Soils

Lime applied to the upper 2 inch surface of an acid Portsmouth sandy

¹Cooperation: Tennessee Valley Authority.

loam soil in May 1940 effected marked decreases in acidity in the immediate zone of application (0-2 inches) proportional to the rate of lime used within one year. A similar change in soil reaction was noted only in the 2, 3 and 4 ton lime application in the 2-4 inch zone, while in each succeeding 2 inch zone (4-10 inches) no appreciable effect on acidity was noted. This suggests that lime did not penetrate the soil much beyond the 4 inch zone, which is in agreement with the amounts of calcium contained in each of the 2 inch zones (4-10 inches).

The penetration of calcium into the different 2 inch zones over a one-year period was proportional to the rates of lime used in the series. At the 2-ton lime application rate only 2% of the added calcium penetrated to a depth of 8-10 inches with no change in soil reaction in the zone. In the 3-ton lime rate about 5% of the added lime penetrated to 8-10 inches with little or no change in soil reaction, while in the 4-ton lime rate 7% of the added lime had penetrated to a depth of 8-10 inches.

The results indicate that in the liming of certain soils a method should be employed whereby the applied lime could be thoroughly incorporated with the upper 6 to 8 inches of the soil, since downward movement of lime appears to be rather slow at ordinary rates of application, with no effective change in soil reaction in the zone of plant root penetration.

The application of lime in-

creased its nitrate content as follows: 1 ton lime, 75%; 2 tons lime, 106%; 3 tons lime 119%; and 4 tons lime, 150%. This suggests that in an adequately limed soil nitrification processes proceed at an increased rate. The nitrogen thus produced through increased microbial activity in a properly limed soil can in some cases help reduce, or in others supplement the nitrogen in commercial fertilizers.

Losses of Potash and Magnesia from Soil Are Influenced by Soil Acidity

Losses of potash and magnesia from the plowed layer of a heavy fertilized Creedmoor coarse sandy loam were measured in out-of-door pots over a period of two months, November 6 to January 10. The soils which were more acid than pH 5.4 and more than 50% unsaturated lost 42 pounds of magnesia, or 38%, and 145 pounds of potash, or 58%. The soils which were less acid than pH 5.4 and less than 50% base unsaturated lost 27 pounds of magnesia, or 21%, and 60 pounds of potash, or 24%.

The losses of potash and magnesia of Creedmoor coarse sandy loam were also measured in the field. The more acid soils had lost 39% magnesia and 59% potash; the less acid soils lost 17% magnesia and 41% potash. These results clearly show that heavy leaching losses of potash and magnesia can be reduced by maintaining a soil reaction at least above pH. 5.4 through liming or through the use of non-acid forming fertilizers.



FIG. 30. CRACKS IN SWEET POTATOES CAN BE REMEDIED BY HAVING BORAX IN THE FERTILIZER.

Fertilizers

Boron Essential for Truck Crops and Flowers

The use of boron in fertilizers in the Wilmington area has become quite general for all crops. Rates of application equivalent to 2 lbs. of borax an acre have given good results with lettuce, but 10 lbs. of borax an acre has seriously injured English peas.

Growth cracks of sweet potatoes (See Figure 30) have been eliminated by the use of borax in fertilizer, and a marked improvement

in the flavor of other vegetables, particularly beets and carrots, has been obtained.

Plants having a subacute deficiency of boron have abnormally crisp leaves. In lettuce this may not appear until the heads are packed in ice. When such a package reaches market, the outer leaves break so badly in handling as to lower the apparent quality of the product.

At a concentration of 2 lbs. of borax in 50 gallons of water, a chlorotic condition of the leaves of



FIG. 31. WHITE BOSTON LETTUCE SHOWS NEED FOR COPPER.

iris has been eliminated with two applications of the spray. Borax at the rate of 1 lb. to 50 gallons is being used with good results as an ingredient of bordeaux mixture for spraying iris.

Copper Needed on Southeastern North Carolina Soils

Many soils in the Wilmington area used for vegetable and flower production have given a response to the application of copper sulfate in fertilizers (See Figure 31). This is independent of the organic matter content of the soil, although larger amounts of copper are required to correct the unfavorable condition of muck and peat than are needed for mineral soils.

The soils needing copper show a high content of soluble aluminum and a low phosphate test for intermediate pH values around 5.5. There has been no clear evidence of a correlation between the solubility of aluminum and the organic matter content of the soil.

The addition of copper to the soil does not immediately eliminate the soluble aluminum, suggesting that the aluminum is more a symptom of some more fundamental

harmful factor than a cause of plant injury itself.

Varieties, especially of flowers, show distinct differences in their apparent copper requirement. The gladiolus, Mrs. Frank Pendleton, for example, will fail to grow satisfactorily without copper on soils where many other varieties do well.

Lime and Phosphate Increase Yields of Lespedeza and Oats

A fertilizer test with oats and lespedeza in a one-year rotation at the Piedmont Branch Station indicate that lime and phosphate increase the yields of Korean and Kobe lespedeza and of Lee 5 oats. In spite of severe drought conditions during the growing season, hay yields of Korean lespedeza were 0.4 tons per acre without fertilizer, 0.7 tons with 40 pounds of phosphoric acid and 16 pounds of potash per acre (one-half applied in fall and spring) and 0.6 tons with lime added to the fertilizer at the rate of 2 tons per acre. Kobe lespedeza with the same respective treatments yielded 0.4, 0.5, and 1.1 tons hay per acre.

In the following year (1941), oat yields in the rotation with Kobe

lespedeza were 13.0 bushels without fertilizer, 19.5 bushels with 20 pounds of phosphoric acid, and 23.0 bushels on plots receiving 2 tons lime in addition to phosphate. Fall application of the different fertilizers was compared with both fall and spring application. The double application yielded 26.7 bushels of oats.

Finely Ground Dolomitic Limestone Should Be Used for Neutralizing Fertilizers

The advantage of fertilizers neutralized with dolomitic limestone has demonstrated their superiority over acid fertilizers in extensive experiments throughout the southeast. All indications favor the

finer ground dolomitic limestone (around 75% through a 60 mesh sieve) as the neutralizing material. The smaller particles decompose during the growing season thereby decreasing the acidity of the soil in the root zone, liberating calcium and magnesium for plant use and stimulating biological activity.

There has been a tendency to use coarsely ground dolomitic limestone as a neutralizing agent in order to give the fertilizer a better mechanical condition. Two tests with Irish potatoes in 1941 showed that the fertilizers neutralized with coarsely ground limestone did not increase yields as much as fertilizer neutralized with the finer material (around 75% through a 60 mesh sieve).

ECONOMIC AND SOCIAL PROBLEMS

Economic Problems

Farmers Paying Delinquent Taxes

A study of 2,150 farms that were delinquent in 1932 has revealed that over 85% of the delinquent taxes have been paid. Only about 15% appear to be permanently delinquent. These facts show that farmers generally are making a real effort to pay their taxes. Since our tax structure is now better adapted to changes in economic conditions, it may be assumed that farmers will not find themselves in such an unfortunate condition after this war as they experienced after the last war, when the tax rates were so high and incomes so low that farmers were unable to pay their taxes when due. The state tax system has been so modified, however, as to make it possible for local governmental units to reduce taxes on farm property and to bring the tax burden of farmers in line with farmers' income. As a result of this adjustment, farmers have been able to pay not only current taxes but also back taxes.

Improving Low Incomes on Cotton Farms¹

A study of 206 farms in Gaston and Lincoln counties has shown that the incomes on typical cotton farms are too low to support a satisfactory level of living for the farm family. The low average income is due to the low price of cot-

ton and the failure of cotton producers to change their farming practices. Farmers have failed to make adjustments needed because they have depended on Government subsidies and also the inertia of farmers to make changes and add new enterprises. Incomes can be increased by following better farming practices and a balanced system of farming instead of depending solely on cotton. Reorganization of the farming system to provide for a better use of farm land, labor, and equipment will result in increased income.

Costs of Ginning Cotton in North Carolina

A study of 63 typical gins through the cotton producing area of the state has shown that it cost farmers from \$2.42 to \$6.54 per bale for ginning cotton in 1940-41. The average cost was \$3.16 per bale. The various items of cost were: Administrative expense, 42 cents; ginning labor, 55 cents; repairs and upkeep, 18 cents; power and fuel, 38 cents; bagging and ties, 18 cents; insurance, 17 cents; taxes, 6 cents; miscellaneous expense, 13 cents; and depreciation, 46 cents.

The volume, or the amount of cotton ginned, affects the cost per bale. For 2,000 bales per gin, 3-stand gins showed lower average costs than 4-stand gins. For larger volumes, 4-stand gins appeared to have higher costs than larger gins.

¹Cooperation: Bureau of Agricultural Economics, U. S. Department of Agriculture.

There is a direct relation between ginning costs and the fee charged the grower for ginning. Gins charging fees from \$2.00 to \$2.99 had average cost of \$2.84. Those with fees from \$3.00 to \$3.99 had average cost of \$3.13. Those with fees of \$4.00 or more had average cost of \$3.37.

Costs of Operating Tobacco Warehouses Revealed

It cost warehousemen \$6.95 in 1938-39 and \$4.95 in 1939-40 seasons to handle 1,000 pounds of farmers' tobacco. These facts have just been revealed by a study of 26 warehouses in 1939 and 17 ware-

houses in 1940. Labor constituted the largest item of expense—almost half of the total—amounting to \$3.20 per 1,000 pounds in 1938-39 and \$2.45 in 1939-40. Building and equipment costs made up approximately one-fifth of the total. Advertising, loss on grower loans, truck hire for free handling of tobacco, and solicitors constituted 13% of the total cost, or 93 cents per 1,000 pounds, in 1938-39, and 10%, or 50 cents per 1,000, in 1939-40. Costs varied from \$7.90 for warehouses with sales of one million pounds or less to \$5.63 for those with sales between four and five million pounds.

Social Problems

North Carolina Leads in Population Growth

North Carolina continues to lead nearby states in population growth. The 1940 population of North Carolina of 3,571,623 was 12.7% greater than the 1930 population. In the entire South, only Florida showed a greater population increase. The percentage increase for the entire nation was only 7.2%. The *urban* population of North Carolina in 1940 was 20.3% more than in 1930. The corresponding figure for the nation was only 7.9%. The *rural-nonfarm* population of North Carolina in 1940 was 24.0% more than in 1930. The corresponding figure for the nation was only 14.5%. The *farm* population of North Carolina was 1,651,197, or 3.4% greater than in 1930. The corresponding figure for the nation was only 0.1%. North Carolina continues to lead all other states, save Texas, in total farm population.

Other important population trends which have been observed are: (1) The changing age distribution—fewer babies and more old people, (2) The continued but slower migration of farm youth to towns and cities, (3) The declining birth rate both on farms and in cities, (4) The continued movement of Negroes off farms into northern cities, (5) A redistribution of farm population due to changes in agriculture and tenure systems, (6) The rapid growth of the nonagricultural population living in the open country.

Farm People Live At Home and Work in Town

In one large area of Alamance County, it was found that 69% of the families living in the open country contained one or more persons who worked more or less regularly in nearby towns and cities. Twenty-nine per cent of these families had two or more, and 7% had

three or more, nonagricultural workers.

These figures show the close relationship between agriculture and industry. Families with low or moderate agricultural incomes are evidently raising their level of living substantially by doing nonagricultural work and are bettering themselves by continuing to live on farms. Many of these rural workers are employed in industries engaged in supplying important war needs.

Opportunities and Need for Improvement in Farm Family Living Revealed

A wide range of needs and opportunities for improvement in farm family living was revealed in a survey of 249 farm families in Harnett County. Although living standards among Harnett County farm families, on the average, are much better than in some sections, a substantial percentage of the families were found to be living under conditions injurious to health and well-being. Serious deficiencies in nutritional resources and housing accommodations were revealed. Of the 199 white families, 31% did not possess milk cows; and of the 50 Negro families, 46% owned no milk cows.

Housing conditions were found

to be deficient in many respects. Adequate home equipment was lacking in the majority of the homes—deficiencies being greater among tenants of both races and among Negro families in all tenure groups.

Family living deficiencies were also reflected in the amount of cash which was available for living. The average cash income for living was \$365. Family doctor and hospital bills were found to be a burden even to those in the higher income groups. The poorer families evidently went without adequate medical care.

Fewer Negro Farmers in North Carolina

The number of Negro farmers, owners as well as tenants, is on the decline in North Carolina (See Figure 32). They are being replaced by white owners and tenants (See Figure 33). During the past ten years (1930-1940), the number of Negro owners has declined from 19,711 to 18,245; Negro sharecroppers from 34,805 to 26,803; and other Negro tenants from 22,334 to 15,191.

The movement of Negro farmers out of southern agriculture is most significant. Apparently, the trend is a long-time one and is not simply a depression or a war phenomenon.

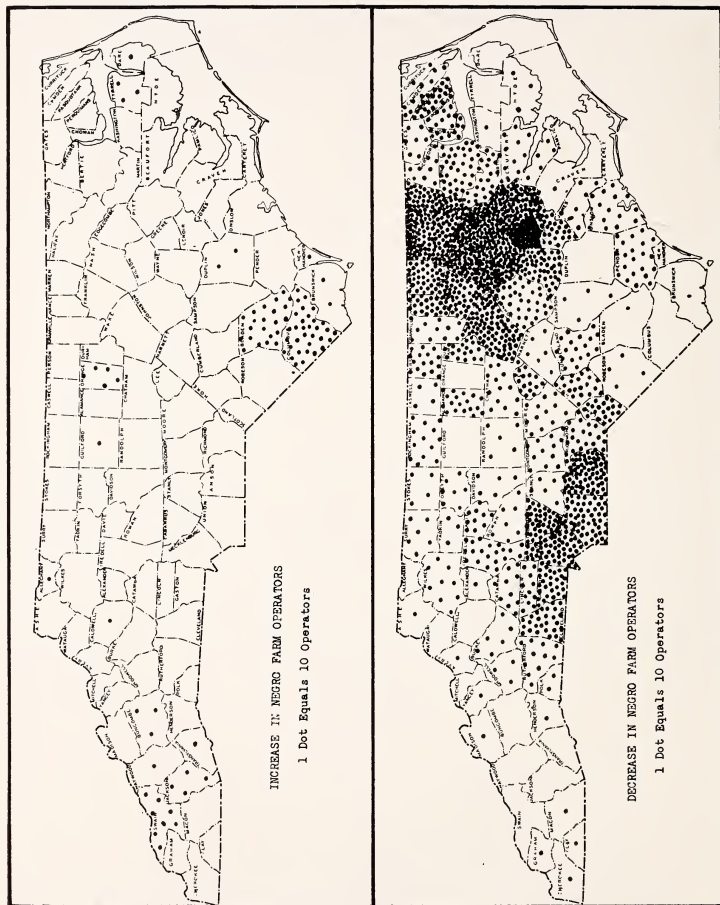


FIG. 32. INCREASE AND DECREASE IN NEGRO FARM OPERATORS BETWEEN 1930 AND 1940

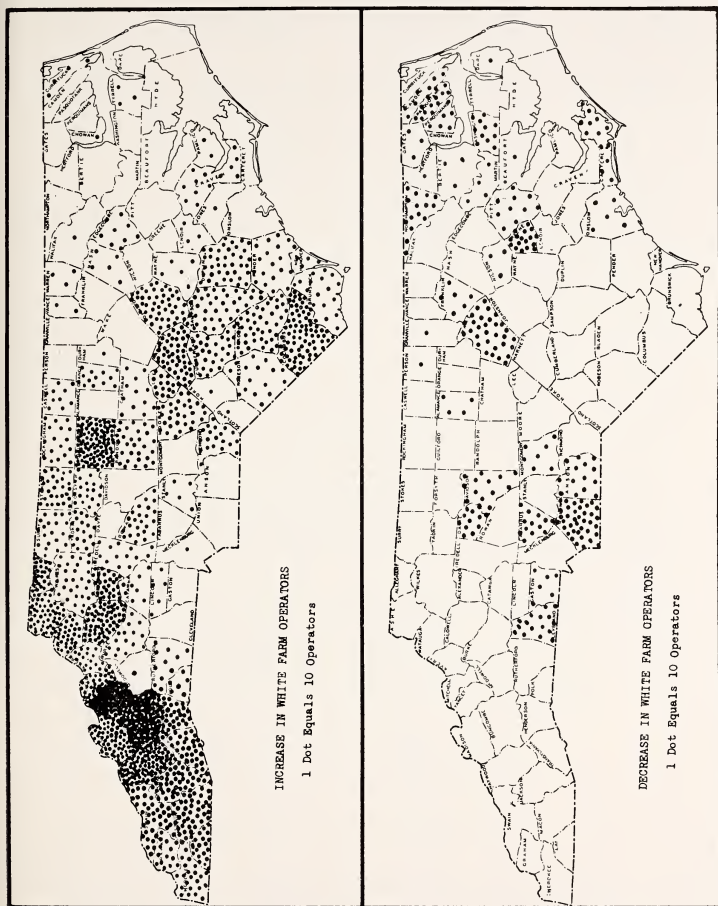


FIG. 33. INCREASE AND DECREASE IN WHITE FARM OPERATORS BETWEEN 1930 AND 1940.

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1. Collins, E. R., and Morris, H. D. *Soil Fertility Studies with Peanuts*. N. C. Agr. Exp. Sta. Bul. 330. 1941.
2. Williams, C. F. *Food Storage in the Peach in Relation to Nitrogen Fertilization*. N. C. Agr. Exp. Sta. Tech. Bul. 67. 1940.

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2. Dearstyne, R. S., Gauger, H. C., and Greaves, R. E. *The Use of Disinfectants in Poultry Production*. N. C. Ext. Circ. 241. 1940.
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4. Maupin, C. J., Bostian, C. H., and Dearstyne, R. S. *Poultry Breeding as a Means of Improving Flock Performance*. N. C. Ext. Circ. 244. 1940.
5. Parrish, C. F., Brown, T. T., Maupin, C. J., and Dearstyne, R. S. *Incubation*. N. C. Ext. Circ. 249. 1941.
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2. Collins, E. R., Giles, G. W., Cumings, G. A., Schoenleber, L. G., Humphries, W. R., and Eldridge, D. A. *A Study of Low-Priced Machines for Fertilizing Southern Crops*. Proc. 17th Ann. Meeting Natl. Joint Comm. on Fert. Appl. Nov. 10, 1941.
3. Collins, E. R. *Survey of Experimental Work Carried on in 1941 Southern Region*. Proc. 17th Ann. Meeting Natl. Joint Comm. on Fert. Appl., Nov. 10, 1941.
4. Greene, R. E. L. *Summary of Returns on 17 Identical Farms in the Coastal Plain Area of North Carolina*. AE-RS Information Series No. 7 (Mimeographed).

¹Alphabetical listing of authors.

5. Greene, R. E. L., and McPherson, W. W. *Major Farming Systems, 1939, and Usual Production Practices, Lincoln County, North Carolina.* (Mimeographed).

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1. Burkhart, L. *Potassium Determination by the Cobaltinitrite Method as Affected by Temperature and pH.* Plant Physiol. 16:411-414. 1941.
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3. Burkhart, L. and Collins, E. R. *Mineral Nutrients in Peanuts Plant Growth.* Soil. Sci. Soc. Amer. Proc. 6: 6:272-280. 1941.
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6. Clement, S. L. *Seasonal Patterns in Tobacco Prices.* American Farm Economic Association, 1940.
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15. Fulton, B. B. *A Luminous Fly Larva with Spider Traits.* Ann. Ent. Soc. America 34: 289-302. 1941.
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22. Middleton, G. K., and Chapman, W. H. *An Association of Smooth-Awnedness and Spring Growth Habit in Barley Strains*. Jour. Amer. Soc. of Agron. Vol. 33, No. 4, April 1941.
23. Middleton, G. K., and Chapman, W. H. *Resistance to Floral-Infecting Loose Smut (Ustilago nuda) in Fall-Sown Barley Varieties at Statesville, North Carolina*. Phytopathology, Vol. XXXI, No. 4, April 1941.
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OFFICERS AND STAFF

of the

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

December 1, 1941

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DAIRY RESEARCH FARM, STATESVILLE

B. F. MILLS.....	<i>Foreman</i>
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	<i>Bureau of Dairy Industry, U.S.D.A.</i>
G. H. MECKSTROTH, Ph.D.....	<i>Associate Pathologist,</i>
	<i>Bureau of Plant Industry, U.S.D.A.</i>
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J. E. LOVE.....	<i>Poultryman</i>
W. M. WHISENHUNT.....	<i>Foreman</i>

PIEDMONT BRANCH STATION, STATESVILLE, N. C.

J. W. HENDRICKS, B.S.....	<i>Assistant Director In Charge</i>
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T. E. SMITH, Ph.D.	<i>Associate, Tobacco Investigations, Bureau of Plant Industry, U.S.D.A.</i>

UPPER COASTAL PLAIN BRANCH STATION, ROCKY MOUNT, N. C.

R. E. CURRIN, JR.	<i>Assistant Director In Charge</i>
WM. ALLSBROOK	<i>Foreman</i>
J. P. YOUNG	<i>Assistant, Tobacco Investigations, Bureau of Plant Industry, U.S.D.A.</i>

* On leave.

†The six branch station farms are owned and operated by the North Carolina Department of Agriculture, and the employees on these farms are members of the Department of Agriculture staff.

¹In cooperation with Bureau of Plant Industry, U.S.D.A.

²In cooperation with Bureau of Animal Industry, U.S.D.A.

³In cooperation with Bureau of Dairy Industry, U.S.D.A.

⁴In cooperation with Bureau of Agricultural Economics, U.S.D.A.

⁵In cooperation with Bureau of Agricultural Chemistry and Engineering, U.S.D.A.

⁶In cooperation with Soil Conservation Service, U.S.D.A.

⁷In cooperation with Agricultural Marketing Service, U.S.D.A.

⁸In cooperation with Tennessee Valley Authority.

AUDITOR'S CERTIFICATE

We, the undersigned, auditors of the expenditures from Federal appropriations and offset to Bankhead-Jones funds reported herein, do hereby certify that we have examined the books and accounts of the North Carolina Agricultural Experiment Station for the fiscal year ended June 30, 1941, that we have found the same well kept and classified as required, and that the balances, receipts, and expenditures are as follows:

	FEDERAL FUNDS					Bankhead-Jones Offset
	Hatch	Adams	Purnell	Bankhead-Jones	Total Federal Funds	
Balance from preceding year	None	None	None	None	None	
Receipts from the Treasurer of the United States	\$15,000.00	\$15,000.00	\$60,000.00	\$102,628.00	\$192,628.00	
Receipts from sources within the State	\$
Total	15,000.00	15,000.00	60,000.00	102,628.00	192,628.00	131,371.01
Disbursements	15,000.00	15,000.00	60,000.00	102,628.00	192,628.00	131,371.01
Balance June 30, 1941	None	None	None	None	None	

Proper vouchers for the above expenditures are on file and have been examined by us and found correct.

WE FURTHER CERTIFY that the expenditures have been solely for the purposes set forth in the acts of Congress approved March 2, 1887; March 16, 1906, February 24, 1925; May 16, 1928; February 23, 1929; March 4, 1931; June 29, 1935; and June 20, 1936, and in accordance with the terms of said acts, and that the Federal-grant funds deposited in banks or the State Treasury have been kept in a deposit or deposits separate from non-Federal funds.

ATTEST:

ROBT. M. SALTER,
Custodian of the Seal.

(Signed) ROBT. M. SALTER,
Director of the Experiment Station
J. G. VANN,
Financial Officer of the Institution

Auditors

FINANCIAL STATEMENT

The following is a certified statement of the receipts from the Treasurer of the United States, supplementary funds from the State Department of Agriculture and sales from the Station farms, with a record of their disbursements:

	FEDERAL FUNDS				Bankhead-Jones Offset
	Hatch Fund	Adams Fund	Purnell Fund	Bankhead-Jones Fund	
Dr.					
To receipts of the Treasury of the United States, as per appropriations for fiscal year ended June 30, 1941	\$15,000.00	\$15,000.00	\$60,000.00	\$102,628.00	
Cr.					
Personal services	11,118.14	12,997.52	44,934.61	77,565.20	63,457.98
Supplies and materials ...	453.51	582.80	2,975.46	6,489.15	15,601.96
Communication service ..	194.68	9.79	203.88	276.72	1,277.52
Travel expenses	709.02	493.70	3,677.11	6,081.65	10,409.55
Transportation of things .	1.76	19.78	20.31	193.05	10.56
Printing or duplication and illustrating publications.	1,031.41		294.53		
Heat, light, water and power (service) ; and fuel			159.49	588.47	1,504.46
Contingent expenses40	.20	4.85	255.02
Equipment	1,491.48	896.01	7,461.22	10,319.59	13,151.64
Land (purchase and rent).				895.32	999.07
Structures and non-structural improvements			273.19	214.00	11,696.48
Total	\$15,000.00	\$15,000.00	\$60,000.00	\$102,628.00	\$118,364.24

Interest earned on Federal funds given above, during the period indicated, aggregating—NOTHING—, was covered by check No. —NONE—, drawn by —xxx—, to the order of the Department of Agriculture, to be deposited in the United States Treasury.

North Carolina Agricultural Experiment Station
In Account with Farm and Miscellaneous Receipts.

Dr.

	Balance from Previous Year	Receipts for 1941	Total
General Fund		\$63,840.14	\$63,840.14
State Department of Agriculture		26,252.26	26,252.26
Special endowments, industrial fel- lowships and similar grants	5,999.88	14,513.90	20,513.78
Sales		20,764.83	20,764.83
Total	5,999.88	\$125,371.13	\$181,371.01

Cr.

Salaries	\$ 49,024.38
Labor	14,433.60
Stationery and office supplies	733.58
Scientific supplies	1,681.52
Feeds	7,178.25
Fertilizers	1,476.85
Other supplies	4,531.76
Communication service	1,277.52
Travel Expenses	10,409.55
Transportation of things	10.56
Heat, light, water, and power (service) ; and fuel	1,504.46
Contingent expenses	255.02
Furniture, furnishings, and fixtures	1,533.56
Library	22.50
Scientific equipment	3,232.05
Livestock	1,179.87
Machinery, trucks, tractors, tools, etc.	7,183.66
Land	999.07
Structures other than buildings, and rent of buildings, or space therein	2,383.55
Buildings	9,248.93
Improvements to land other than added structures	64.00
Unexpended balance	13,006.77
Total	\$181,371.01

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THE AGRICULTURAL EXPERIMENT STATION
OF THE
NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING
AND
NORTH CAROLINA DEPARTMENT OF AGRICULTURE, COOPERATING
L. D. BAYER, DIRECTOR
STATE COLLEGE STATION
RALEIGH, N. C.